RADIO AND HOBBIES IN AUSTRALIA

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PLANS OF THE DORNIER 217E

RADIO AND HOBBIES IN AUSTRALIA

BAN ON NEW RECEIVERS

BIGGEST NEWS in radio circles for the month is the order which virtually prohibits the manufacture of new radio equipment for civilian use. The measure was not altogether a surprise, for the whole radio trade has been well aware, during the past year in particular, of the rapidly deteriorating parts position.

As yet, it is rather early to try to suggest all the implications of the order, but it is reasonable enough to assume that it will apply equally to everybody, recognised manufacturer and homebuilder alike, wherever the construction of new apparatus requires the purchase of new parts.

According to a published statement by the Minister for War Organisation of Industry (Mr. Dedman), the measure is of a temporary nature, subject to review at a later date. It may well be, therefore, that the manufacture of new receivers will be permitted again before the end of the war, perhaps under permission of the Minister of the Directorate of Radio and Signals supplies.

We have been assured by a spokesman for the Department for War Organisation that the prohibition does not in any way affect or replace proposals for the rationalisation of the radio service industry; these proposals have been the subject of previous editorials in this journal. It is intended to put into effect measures, as yet undisclosed, at the earliest opportunity.

Recognising the severe shortage of radio parts, express purpose of the new regulation is to conserve what stocks there are for purposes of maintenance. As a purely emergency measure, this is reasonable enough, for the parts which go to make up a new receiver are sufficient to keep quite a number of receivers in operation for a couple of years.

On the other hand, it must be recognised that radio receivers deteriorate with age and a complete blanket on civilian-set production for the duration may result in many newly-set-up homes being left without a receiver, and a state of affairs where excessive manpower and material is consumed in wasteful patching-up of derelict sets. It is to be hoped, therefore, that the means will be found to permit some manufacture of new receivers, even on a restricted basis.

On page 48 of this issue, we introduce a new feature—"This Month's Recordings." The section is in response to many requests for a review of the latest recordings and it should be of special value to amplifier enthusiasts, who have not the opportunity to hear new recordings for themselves.

"Audisc" is not attempting to write for the reader who boasts an intimate knowledge of composers and their works. He is seeking to present the section in a way that will be both interesting and instructive for the average amplifier enthusiast.

W. H. Williams

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WAYS AND MEANS OF MEASURING TIME

Now a museum piece, the marked candle was once quite a popular method of keeping track of the passing of time. For obvious reasons, it could not be relied upon to give split-second accuracy, but it was at least far better than pure guesswork. The candle shown above was supposed to burn at the rate of one division per hour.

Some men have plenty of it; some have just enough; some have far too little. Some make it, some steal it, some lose it, some waste it, some can never keep it. Yes, you've guessed it! We are speaking of time—that elusive, rather hard-to-define something which regulates, rules and limits our lives.

IN these days of competition and high speed living, time has become an increasingly important consideration. The success or otherwise of modern war depends to a large extent, on the time factor. For an army on the defensive, speed is the important thing; the defenders play for time by every trick they know.

Then there is the boss' time, which, of course, is not at all valuable. This is the only kind of time, the wasting of which is a popular pastime among the working people.

There is the story of the office boy who was missing for part of the morning. On his return the boss asked him where he had been. "Getting my hair cut, sir," said the lad. "But," said the boss, "you had no right to do that in my time, you should do that in your own time." "Why?" said the boy. "It grew in your own time," snapped the boss! "Not all of it, sir," answered the lad.

The inventor of the clock rendered a great service to suffering humanity. He gave them something to watch during working hours (make a note of that pun).

Without a watch there would be no racecourse punters. Fancy timing a horse race by means of a sundial! And, of course, there is the matter of appointments, although, in this case, guessing seems to be the favorite method.

The only places where time doesn't count are Government departments. If you don't believe me, just go along to the Income Tax Department for a refund.

All jokes aside, this time business is serious. I am five years older than I was five years ago. I can feel it in my bones.

There was a period in the world's history when the only method of telling the time was by observation of the sun and the shadows it cast by day. At night, it became a matter of guesswork by the position of the stars.

Marking out of the time into precise intervals of seconds, minutes, and hours was not possible by this haphazard method. The early Greeks, highly civilised as they were, usually indicated the time by terms such as dawn, noon, and sunset.

Herodotus, a Greek historian who lived in the 5th century BC, informs us that the ancient Babylonians were the first to hit on a more accurate method of time telling, by means of the sundial.

THE SUNDIAL

Historians are now agreed that the sundial was the first timekeeper ever to be used by man; evidence shows us that sundials were used in the valleys of the Tigris and Euphrates as early as 2000 BC.

It is obvious that it must have been observed, even by the most primitive man, that the shadow cast by a vertical object changed its length and position during the course of the day.

But it was left to the Babylonians to make use of this knowledge by placing a rod in the ground so that its shadow would be cast on to a smooth horizontal surface. Later on, this surface was divided into equal intervals, roughly equivalent to hours.

The sundial is mentioned in the Bible in Isaiah 38, and the eighth verse. "Behold, I will cause the shadow on the steps, which is gone down on the dial of Ahaz with the sun, to return backwards ten steps. So the sun returned ten steps on the dial, whereon it was gone down." Ahaz reigned a little before 700 BC.

Sundials were known in Greece as early as 400 BC. The Greeks, as could be expected, added greatly to its variety and forms, but the vertical rod remained the essential part.

APPOINTMENTS BY THE FOOT

It is interesting to note that the length of a man's shadow was often used. One would make an appointment for a time when the length of a man's shadow was a certain number of times the length of his foot.

From Greece, the sundial spread to Rome, and in this city the device seemed to prove very popular. The first dial mentioned at Rome was one that was placed in the court of the Temple of Quirinus in 293 BC. Plautus of Rome got very annoyed at the introduction of the sundial, and he wrote a poem in order to say so. It is worth repeating here:—

"The gods confound the man who
first found out

by Calvin Walters

THE EVOLUTION OF THE MODERN CLOCK

How to distinguish hours—confound him, too,
Who in this place set up a sundial,
To cut and hack my days so wretchedly
Into small pieces! When I was a boy,
My belly was my sundial—one more sure,
Truer, and more exact than any of them.
This dial told me when 'twas proper time
To go to dinner, when I ought to eat;
But, now-a-days, why even when I have,
I can't fall to, unless the sun gives me leave.
The town's so full of these confounded dials,
The greater part of its inhabitants,
Shrunk up with hunger, creep along the street."

So wrote Plautus, who died in 184 BC. It is clear that sundials must have been very common in those days.

PORTABLE SUNDIALS

Sundials continued to be used during the early Middle Ages, and spread all over the civilised world. All kinds of fancy dials were devised. Even portable sundials came into being about the size of a small watch. These were used by holding up to the sun in a certain position, so that the sun shone through a small hole and cast a spot of light on to a ring. The position of this spot indicated the time.

The Egyptians were the next race to delve into timekeeping, and to them is credited the honor of inventing a more accurate timekeeper, the Clepsydra.

This instrument was, at first, only a timekeeper for limiting the length of public speeches, &c. It took the form of an earthenware vessel with a small hole in the bottom. Down the sides of the inside of the vessel were marks.

Water was put into the jar and trickled out of the hole at the bottom. As the level of the water lowered, these marks came into view and indicated the interval of time during a speech. Thus a politician may speak for three, four or ten divisions of time, or a whole jar full, according to his capabilities or the patience of his audience.

CLEPSYDRA WITH DIAL

Later on, the Clepsydra was given a mechanical attachment. This took the form of a conical funnel, the stem of which led into a cylindrical vessel. Inside the cylinder was a float to which was attached a rod with cogs. These cogs engaged a cogged wheel to which was attached a hand which moved over a dial.

The action was as follows. As water from the funnel dripped into the cylinder, the water in the cylinder was thus raised. The float would also rise and thus carried the rod upwards which would in turn revolve the cogged wheel, and also the hand across the dial, which would be marked off in appropriate divisions.

In dry climates, where water was a precious commodity, the simpler form of Clepsydra was operated by sand. Of course, sand could not operate a float, but, by collecting in the reservoir, the height of the sand could indicate the time.

In addition to this, sand always ran at a regular rate, and could thus be made more accurate.

Later, when glass came to be known, the sand was enclosed in glass bulbs which were double ended, and, lo and behold, we had the hour glass, which is with us to this day. So we see that the Clepsydra was the forerunner of the hour glass, which we use now merely for that uninspiring pastime of boiling eggs.

THE HOUR GLASS

From about the 16th century, the hour glass was used in churches to limit the length of speeches, but it was not always reliable, for many preachers surreptitiously turned the glass over, thinking, no doubt in all good faith, that his talk was more valuable to his listeners' souls than the extra time they would have had in idle chatter at the porch door.

The Clepsydra became a very complicated piece of machinery as the years rolled on. Not only was a hand made

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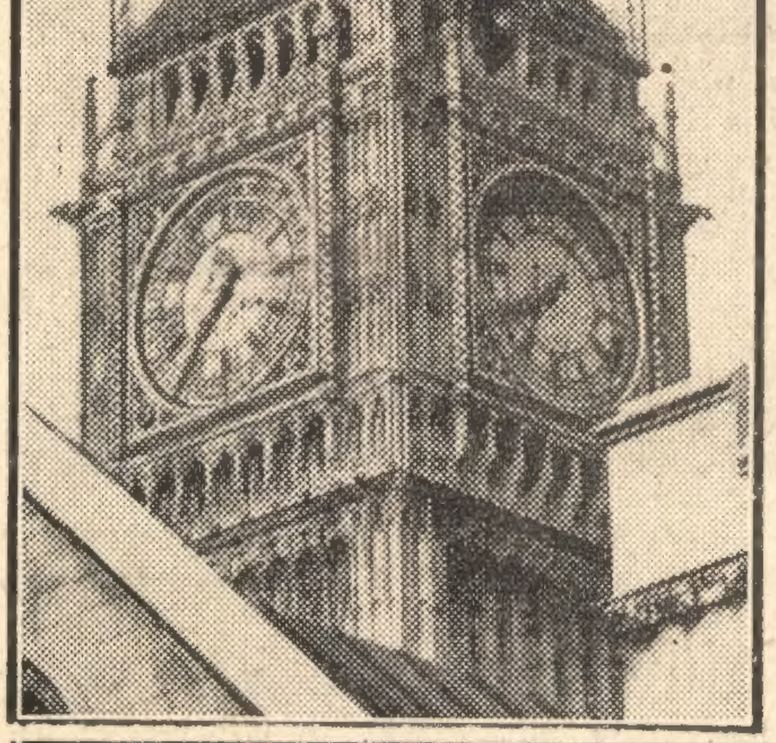
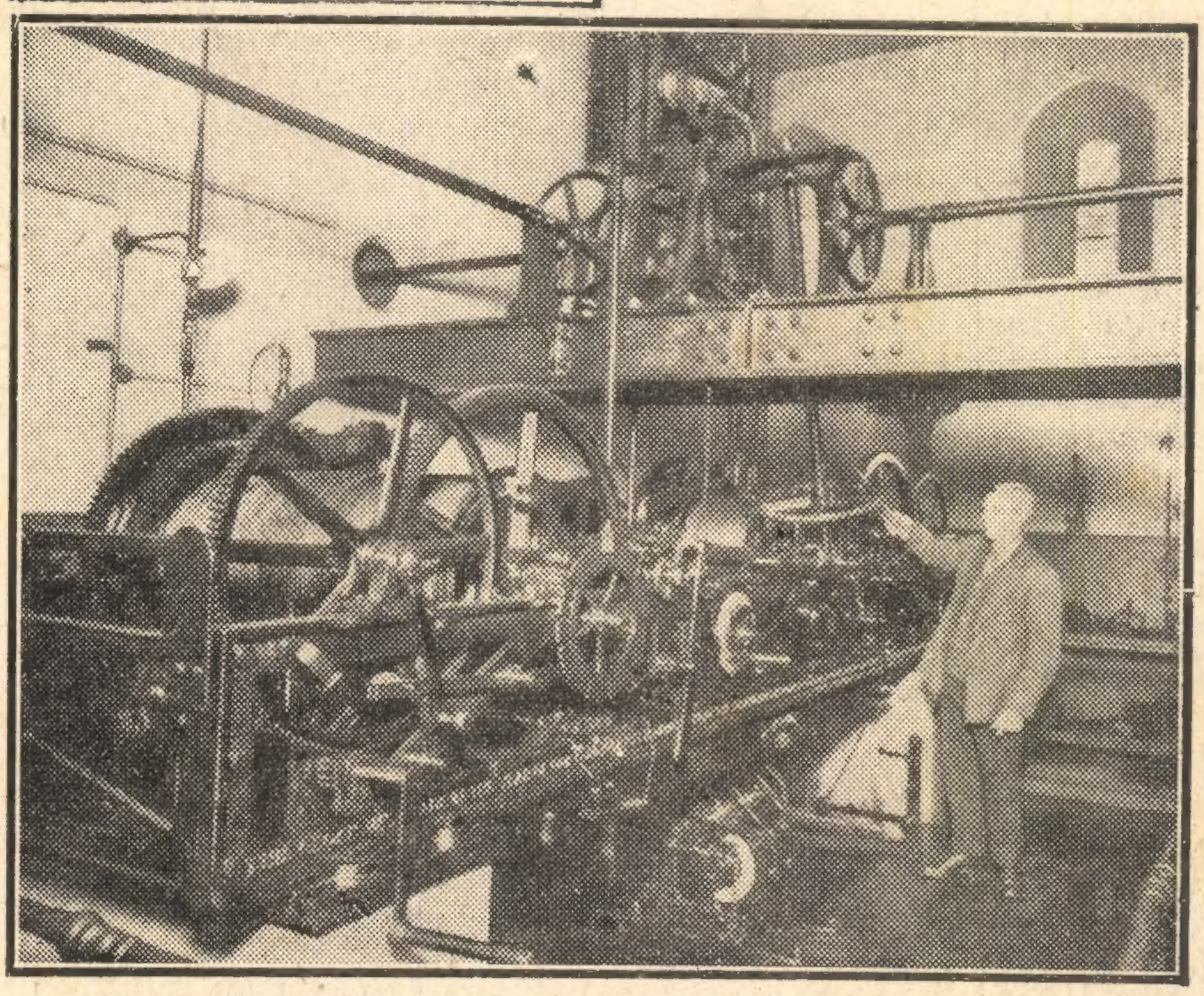
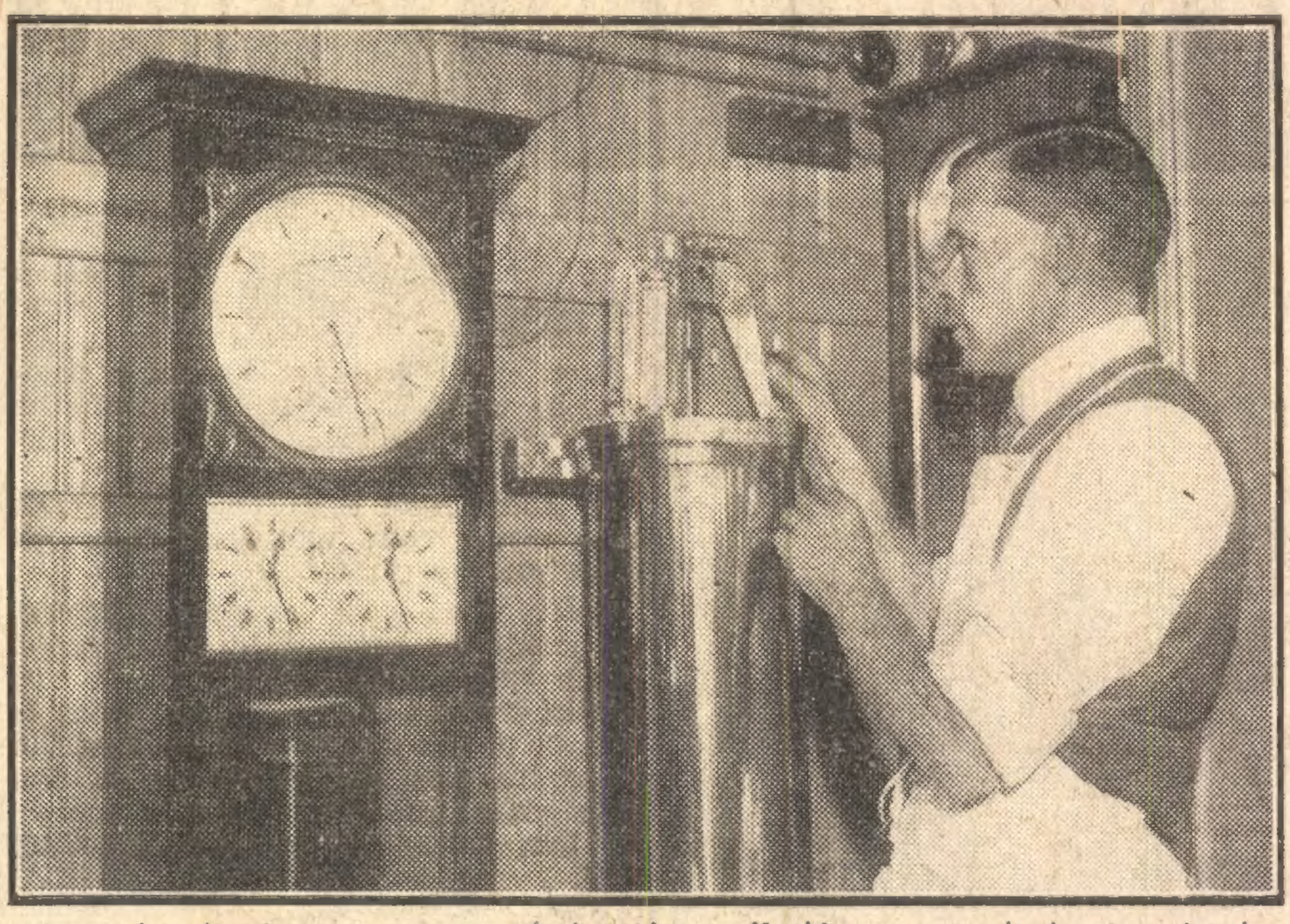




Undoubtedly, the best known clock in the world is London's Big Ben. Day after day, its chime is heard by millions of people per medium of the BBC broadcasts. As the picture above clearly shows, its mechanism is massive—more reminiscent of a war factory than a timepiece.

FEATURE STORY

THE WORLD'S MOST ACCURATE CLOCK



Reputed to be the most accurate clock in the world, this one controls the time signals from the Greenwich Observatory. Built by a London firm, it has an accuracy of better than plus or minus one quarter second per year.

to move over a dial, but a large number of mechanical operations were performed by means of trains of cogged wheels.

A typical example was the Clepsydra that was given to Charlemagne by the King of Persia in 807 AD.

This instrument had a dial of 12 small doors, which represented the hours. Each door opened at the hour it represented, and out would fall the same number of small balls, which fell one by one at equal intervals of time on to a brass cymbal. It was thus possible to tell the time by watching or listening.

At 12 o'clock 12 small horsemen issued forth and shut all the doors.

We see then that with its trains of wheels and mechanical devices, the Clepsydra was the ancestor of the modern clock.

A further development of the Clepsydra was a weight attached to a drum. The weight was attached to a cord, and this was wound on the drum.

USE OF WEIGHTS

The weight pulled the cord down, which, in turn, revolved the wheels attached to the hand. Next a little fan was added to regulate the speed at which the drum revolved. This fan offered resistance by air friction, and it was therefore necessary to wind the weight up less frequently than before. More accuracy was therefore possible.

But still the instrument was not uniform in its timekeeping, so some early inventor got to work and invented a balance, verge and crown wheel.

Who this inventor was nobody seems to know, but a clock incorporating this device put in an appearance in 1360. This clock was made by Henry de Vick, of Wurtemberg, for Charles the Fifth of France.

This clock had only an hour hand, and kept excellent time—for those days—not much better than two hours a day.

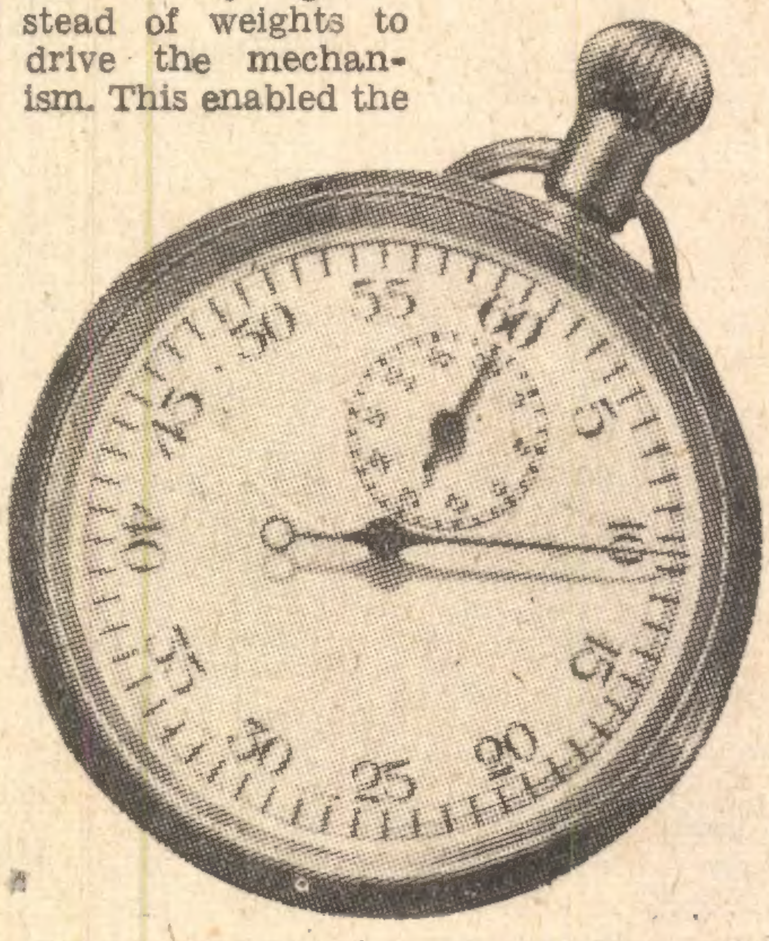
It is possible that the mechanical clock of today owes its origin to no particular person, but came about by a process of evolution. One idea after another being added as the centuries went by.

Domestic clocks were not common until about 1600 AD. Up to this time, the only clocks were the cathedral clock or tower clock still without the minute hand.

GUILD OF CLOCKMAKERS

By this time clocks were common in England, and in 1630 a Guild of London clockmakers was formed, called "The Master, Wardens, and Fellowship of the Arts and Mystery of Clockmaking of the City of London."

The next improvement in clocks was the mainspring instead of weights to drive the mechanism. This enabled the mechanism to be enclosed in a smaller space and led to the introduction of clock-watches. A craze developed, and manufacturers vied with each other in making as fancy a watch case as possible. Very beautiful work was produced in the way of etched and handworked gold cases.



These days, every home has at least one clock and most people have a watch to indicate the time when out. Here is a typical stop watch, capable of being read to within about 0.1 of a second.

In 1658 a great invention revolutionised the construction and accuracy of clocks. This was the invention of the pendulum. Again, no particular individual can claim the honor as his own, although historical opinion favors the Dutch mathematician Christian Huygens, who produced a pendulum clock in 1657.

NUMEROUS DEVELOPMENTS

The pendulum clock was the most accurate clock to this date. From then on idea followed idea. New escapements and controlling mechanisms and eventually, just before 1700, the concentric minute hand was added.

Just imagine all those years, and no minutes to worry about. Only hours! How time must have lagged.

Then came improvements in dials. Brass dials, glass dials, bronze, etched, handworked dials, enamelled dials and so on. Eventually the second hand came and from then on nothing but a race of improvements.

The space available makes it impossible to enter further into the history of the block, but I do not think that this article would be complete without some reference to some of the famous clocks that have been made.

Practically every old city in Europe and England has its famous clock, but the astronomical clock in the cathedral of Strasbourg, in Alsace, is without doubt the most famous clock in the world.

STRASBOURG CLOCK

A model of this clock can be seen in the Technological Museum at the Sydney Technical College. This model had run down since the death of its maker, and no one knew how to set it going again until lately. It is now in operation, and lectures are to be given on the mechanism.

There were really three Strasbourg clocks. The first was made in 1352, but was worn out by 1500.

The second was completed in 1574, but was struck by lightning in about 1640, and after repair commenced to deteriorate; in 1818, after endless repairs, it was discarded.

The third and present clock was made by Jean Schwilgue in 1842, after four years work. It cost 101,375 francs.

It is 30 feet high, and 15 feet wide at the base. A flight of winding stairs gives access to the various galleries of the clock.

OPERATED BY WEIGHTS

The mechanism is driven by weights. In front of the clock is a globe representing the celestial sphere, showing all stars visible to the naked eye.

This globe turns and indicates the time of rising and setting of the stars. There is a calendar that shows the date and the fixed and movable feasts. The calendar changes automatically at midnight on December 31. In the middle

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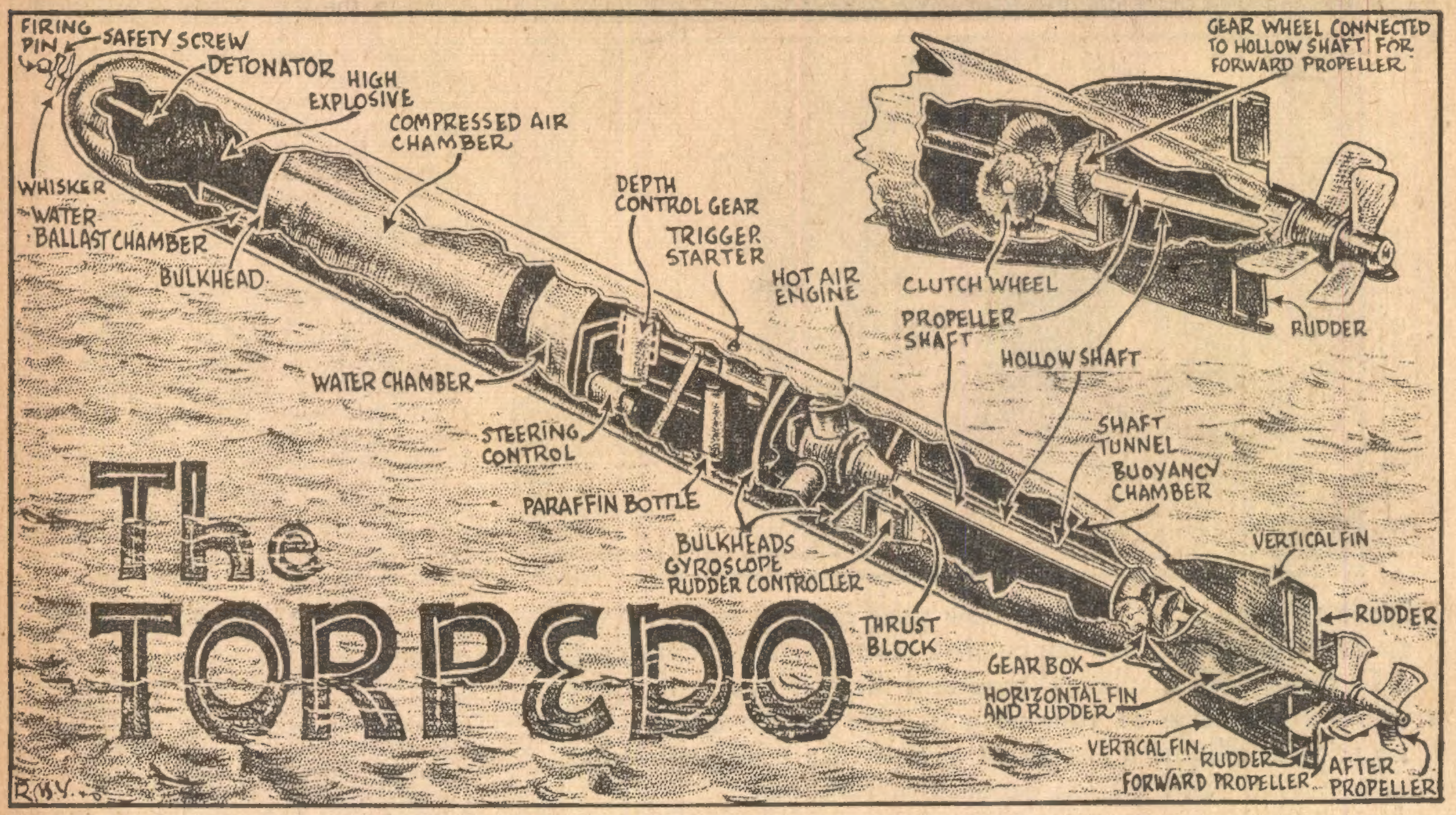
"HOW IT WORKS"—BY R. M. YOUNGER



The TORPEDO

Most destructive of the weapons of naval warfare is the torpedo. From surface ships, submarines and speedily-designed aircraft, these potent cigar-shaped marvels of destructive ingenuity are being fired daily, and the score of their victims is ever-growing.

ALTHOUGH torpedo-like devices for damaging ships had long been in use, it was not until 1866 that Robert Whitehead invented his celebrated torpedo, upon which improvements have been continuous. It is the Whitehead automobile torpedo, or modifications of it, that is used almost exclusively by all navies.

The sketch above shows the essential components of the torpedo, which is divided into three main parts—the warhead, containing the detonator and explosive charge; the forebody, containing the compressed air chamber and some of the steering control gear; the after body, in which is placed the mechanism for propelling and regulating the torpedo.

The case or shell of a torpedo ranges from 18 to 22 inches in diameter and from 16 to 22 feet long. On the outside, at the rear, like the tail of a fish, are the propellers and rudders. Inside is placed one of the most complicated pieces of mechanism ever devised by man—consisting of over 6000 parts, all made with precision at least as great as that of the tiniest parts of a wristwatch.

Motive power for driving the torpedo through the water comes from the amazingly efficient little four cylinder hot-air radial motor. Though it weighs only a few pounds, it develops about 400 horsepower. The air supply is contained, under pressure, in a strong chamber, occupying nearly one-third of the length of the torpedo, immediately aft of the warhead.

The starter is placed just forward of the motor. Also in this section are the hydrostatic depth control gear, the steering control for the horizontal rudders, the starting gear and the pressure reduction gear—all highly complicated and intricate components.

STEERING GEAR

The steering gear is equipped with a gyroscope for keeping the torpedo true to its course, and a buoyancy box is placed at the top part of the aft end, thus helping to keep the torpedo upright. To prevent torque, two propellers, turning in opposite directions, are used. The rear propeller is powered by a solid shaft working inside the hollow shaft to the forward propeller.

In the front compartment of the warhead is the explosive—250lb. or more—and projecting from the head is the "war nose," which carries the firing pin and releasing screw. As the torpedo is driven through the water, the blades of the fan are turned, so that the firing pin is unlocked. Then, when the torpedo strikes the enemy ship with its war nose, the firing pin is driven in and explodes the charge. The speed at which a torpedo travels varies from 30 to 50 miles an hour—the latter being greater than the speed of the fastest warship.

A torpedo is discharged from a surface vessel or sumbarine thus: Sailors slide the torpedo into one of the boat's torpedo tubes, closing the inside door of the tube and then opening the outside or sea door at the opposite end of the tube. A valve is opened by electricity and the torpedo is shot out by compressed air. Above-water tubes are fitted in all torpedo craft and many cruisers.

UNDERWATER TUBES

The danger of the torpedo's head being detonated, or air vessel burst, by hostile shellfire is accepted for these vessels. To avoid this danger, systems of under-water discharge have been devised. The submerged torpedo tube has the further advantage that the torpedo, at the moment of release, cannot be detected by the enemy.

In torpedoing from aircraft, the torpedo is slung on arms underneath the fuselage and the plane comes down to within 100 feet of the water and releases the torpedo about 1000 yards from the target. The plane then turns and escapes down wind.

As the torpedo is released, the control and motor mechanism is put into motion and operates the torpedo in the water. The normal torpedo keeps to a straight course. It is reported that the Germans

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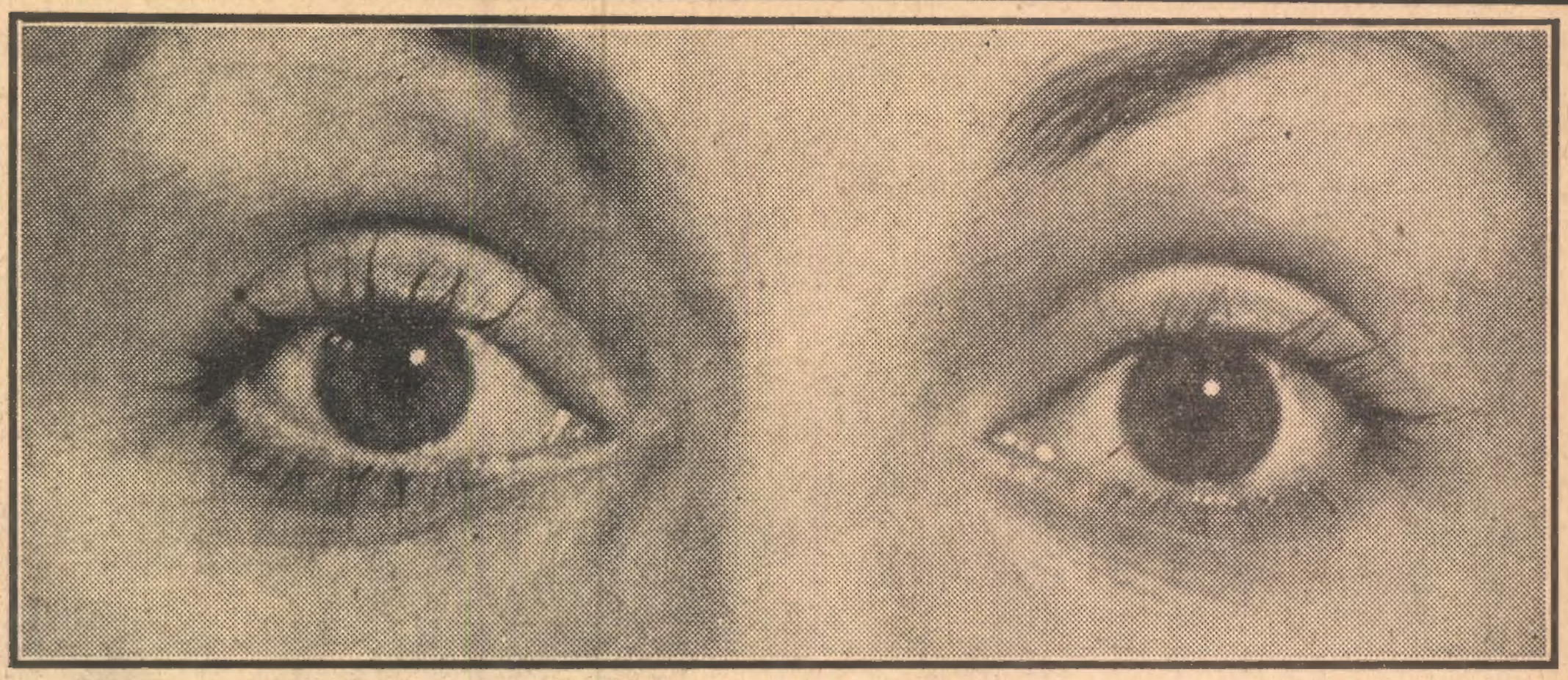
FEATURE STORY

PERFECT EYES ARE IN THE MINORITY



Some millions of years from now your great-great-great and so forth grandson, say speculative doctors, will probably be a Cyclops, with a solitary large and melting eye in the place where the bridge of your nose is. He will have practically no nose at all, just a couple of airholes like a hippopotamus, and a huge expanse of forehead.

YOU can already see the change beginning. In most people one eye, usually the right in right-handed people, does most of the work seeing and the other rests off. This sketch of the face of the future is startling, but nothing to mourn over, since by the time it arrives the Cyclops face will certainly be considered handsome.

Besides, in that one eye, your remote descendant will have a far more efficient seeing machine than your two eyes ever afforded you. In the meantime, human beings have to put up with a seeing machine only a little better than an ape's, and go to all kinds of trouble to make this inefficient instrument work as well as possible.

STRUCTURAL DEFECTS

Since the machine is made of living tissue, instead of glass and steel, it is bound to get out of order in many weird ways. To make things more inconvenient, it was probably manufactured faultily to begin with.

Whether they know it or not, four out of five people have structural defects in their eyes which would quite justify them, if it were feasible, in sending their eyes back to the manufacturer and asking for new ones or their money back.

Glasses are the eye doctor's standby, nowadays, just as indispensable as the scalpel to the surgeon. But they were developed not with the co-operation of the medical profession, but in the face of bitter opposition. Spectacles were known and widely used in Europe for five hundred years before the eye doctor ever admitted there was anything to be said for them.

Instead, he stubbornly insisted on getting nowhere with such methods as applying leeches to the eyebrows, using "strengthening" eye washes, and advising his patients to cure their eye troubles by riding horseback, playing billiards, and eating two-day-old bread.

The spectacle business was left to peddlers, quacks who hawked crude glasses up and down the streets and let customers try one pair after another until they found something that felt comfortable.

by L. B. Montague

Lunatic as the procedure sounds, a far-sighted man did stand a chance of finding a pair of lenses that would do him some good. For astigmatism and near-sightedness, however, it must have been a grave risk of ocular suicide. Even after the optician with a permanent shop had put the peddler's nose out of joint, methods were still dismayingly hit or miss.

They even had bifocals long before glasses were officially admitted to the consulting-room. Bifocals were invented by Benjamin Franklin, who got bored with being unable to see across a room with his reading glasses on, and had himself a small semi-circular reading lens soldered into a big plain glass lens.

At that, European civilisation got the idea very late, waiting until the Arabs brought lenses to Spain along with algebra, the beginnings of chemistry and the comforting art of distilling strong waters. The Chinese were using glasses way back when a goggly pair of horn-rimmed specs were essential to the professional prestige of an ancient Chinese doctor.

THE OPHTHALMOSCOPE

It was the nineteenth century's invention of the ophthalmoscope, an instrument enabling doctors to look into the interior of the eye, which made the difference and enabled the doctor to prescribe for glasses on a scientific basis.

And that brings us to the three O's: oculists, opticians, and optometrists. We may as well get those labels properly straightened out: an oculist is a doctor, an MD, specialising in eyes; an optician is a craftsman who grinds lenses to prescription and sells them in frames; an optometrist is a man trained to observe structural defects in the eye and prescribe lenses, but he is not a doctor qualified to diagnose diseases of the eye—and eye diseases are practically the only eye conditions which result in seriously defective eyesight or blindness.

The optician and the optometrist set up shop together in many cases. Before the ophthalmoscope, optical investigation went on by guess in non-medical hands. Astigmatism was discovered by a young man who was annoyed to find that neither converse nor concave lenses, the only dodges known to the optician, would do his eye troubles any good.

Color blindness was unknown until an English Quaker, a very stiff old gentleman, produced a scandal one day

SEEING IS A COMPLICATED BUSINESS

by appearing in meeting with a new coat—properly cut, as a Quaker's coat should be, but made of bright red broadcloth. The only thing that saved him from being read out of meeting was the friend's discovery that he had bought the coat in good faith, believing it to be grey—for both red and green were just so much grey to him.

The question of whether or not any given individual ought to wear glasses is a ticklish one. Nowadays, more progressive oculists are going as easy as possible on prescribing glasses, and taking glasses off people when there is the slightest excuse for doing so. That tendency has little to do with the recent advocacy of a well-known movement to abandon glasses altogether and depend on complicated exercises of the muscles of the eyes to cure structural troubles.

GLASSES OR NOT?

The orthodox oculist, no matter how advanced, gets so warm on that subject that steam comes out of his ears. His new willingness to use glasses to the minimum extent possible is rather the result of discovering that it is not necessary to correct all defects with lenses and of recognising the psychological fact that spectacles are often a nuisance, especially to women.

The average smart woman would almost rather shave her head or wear high boots to a dance than put on spectacles for permanent wear in public as well as in private. This frantic feminine repugnance to being sensible and wearing spectacles all the time has caused the optician to design glasses that reduce disfigurement to a minimum—rimless, clear, high-slung, delicate spectacles that come as near as ingenuity can to giving a pretty girl a break.

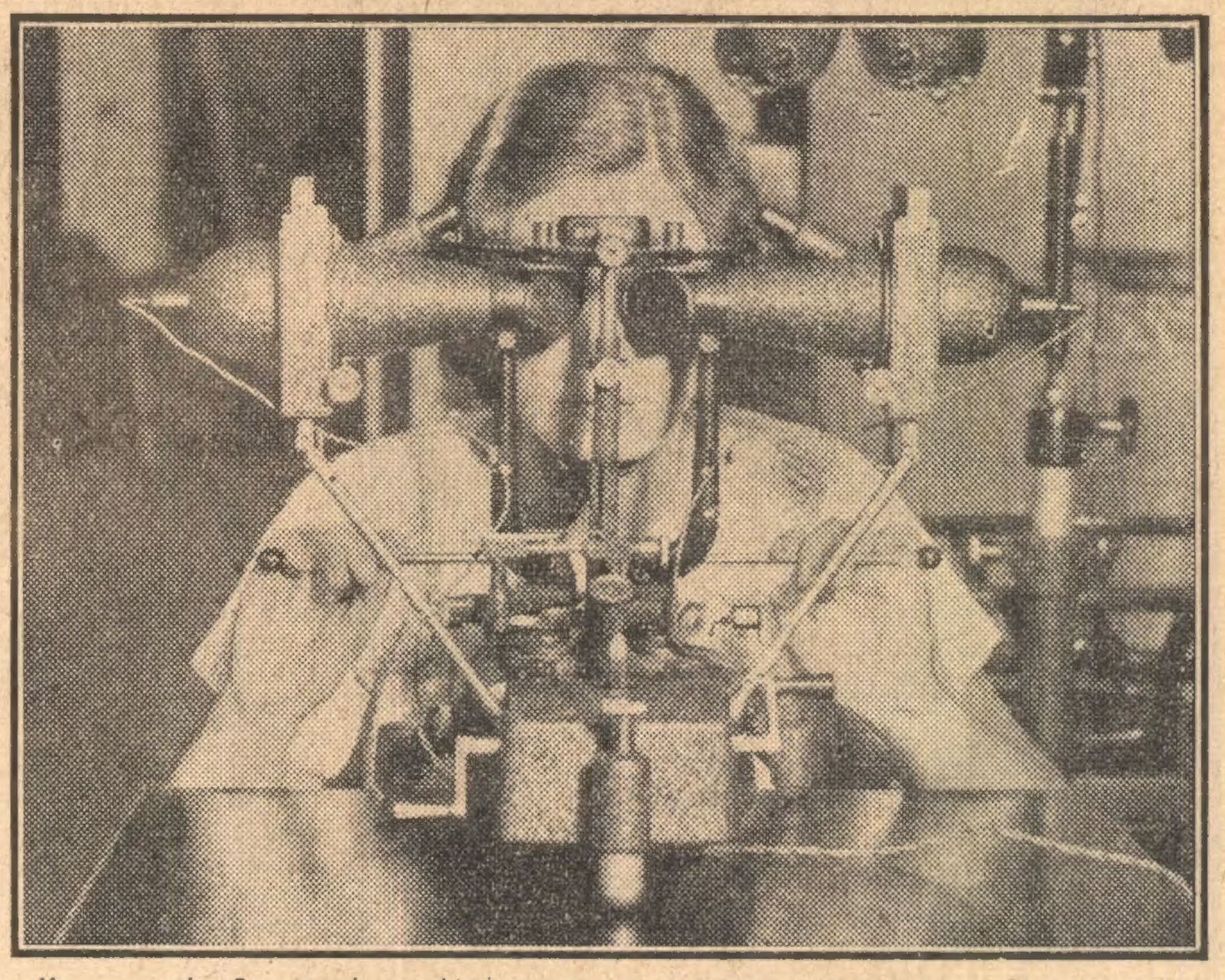
After fifty years of experiment, scientists have found an eventual way to the near-sighted maiden's heart by perfecting the "contact lens."

CONTACT LENSES

A contact lens is an incredibly thin concave piece of glass shaped to the exact curve of the eyeball with the centre, which covers the opening of the eye, ground to correct the eye's faults. The ground variety is all clear glass, practically imperceptible, because the natural eye shows through and the glass reproduces the natural lustre of the eyeball.

The blown variety has clear glass only over the iris and pupil, with the rest ingeniously colored to reproduce the veining of the eyeball. Expert fitting, a long and tedious process of trial and error, seems to have the problem of irritation pretty well licked.

Sea captains wear them to avoid the nuisance of spray on ordinary glasses. They're very handy for athletes. And the glances of several of your favorite Hollywood actresses are no less lustrous and enchanting because they are filtering through invisible contact lenses.



Known as the Synoptophore, this instrument is used to correct squint and to improve the vision of a near-blind eye. Illuminated stereoscopic pictures are presented to each eye and can be brought into register by manipulation of the handles. Calibrated pointers indicate the degree of error in the subject's vision.

These delicate little gadgets have two disadvantages—one, that they can do no good for lenticular astigmatism which is the rarer variety—the other, that as they were previously imported from Germany and required extremely ingenious workmanship, they are now not only difficult to obtain, but they cost about ten times as much as ordinary spectacles.

Ordinary glasses are usually prescribed by standardised "cut-and-try" methods, different lenses being slipped into special test frames until the best results are obtained.

Oculists who prescribe them say that, risky as this notion of putting glass in contact with the eye may sound, there is very little danger from breakage. The lens is held so firmly between eyelids and eyeball that even a direct blow can hardly hope to shatter it.

Injury to the eye from shattering spectacles is illogically rare, anyway. It is likely that, by helping to keep foreign objects out of the eye, glasses have done far more good than harm in that line.

SHATTERPROOF SPECS.

Eventually all spectacles may be made out of non-shatterable glass, the same sort of thing only more refined, which is used in windshields. The glass is already in use, but it is more expensive than the ordinary kind, and oculists usually prescribe it only for people who are blind in one eye—for grim and obvious reasons.

The delicate complications of the visual organ always astound the layman—and the scientist, too. Charles Darwin, who certainly believed heartily in his own theory of evolution, once said he despaired of ever accounting by any process of gradual development for the unsanely ingenious process of seeing.

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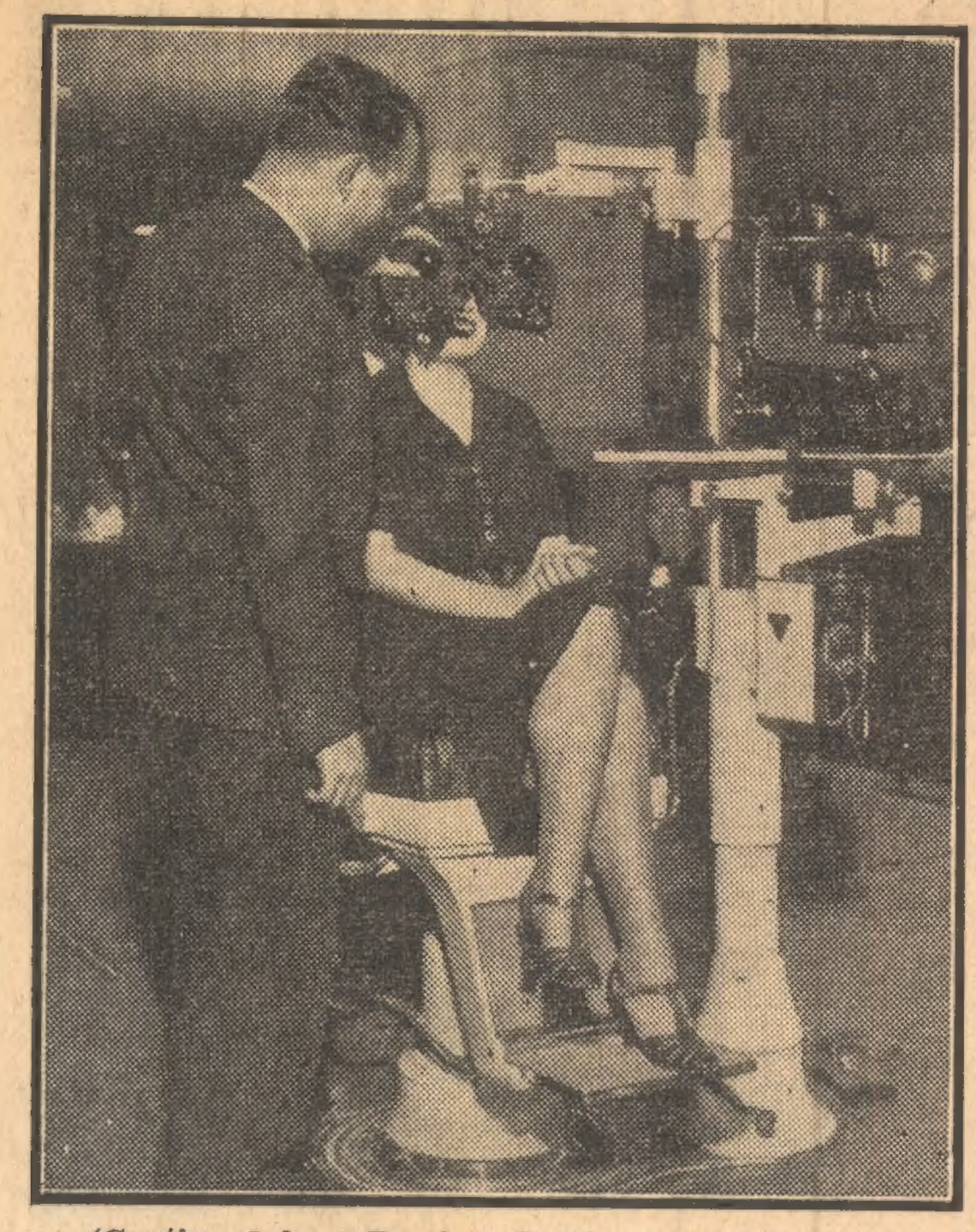
FEATURE STORY

MODERN DEVICE FOR TESTING EYESIGHT



Looking uncomfortably like a dentist's chair, this is really the "Greens Refractor" — an all in one device for the prescription of glasses. In so many eyesight tests, the eye doctor has to rely on the observation of the subject and every effort must be made to obviate error from this source.

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(Continued from Previous Page)

No other sense is so weird a combination of the tangible and intangible. Feeling is probably a matter of pressure on the nerve ends, taste and smell of chemical reaction. Set your teeth on a grand piano in action, and you can literally feel yourself heating by vibration through the resonant bones of your skull.

But seeing involves the automatic co-operation of two self-focusing miniature cameras each the size of a walnut, each taking a separate colored picture of the same thing, with the two branches of the optic nerve working together so cleverly that they telegraph only one three-dimensional picture to the brain —and all so accurately that the brain can direct the hand in operations as delicate as watch-making.

That is merely the mechanics of it. On encountering the physiology of the eye as a living organism, the layman can merely apologise for intruding and go away in a hurry.

ANALOGY OF CAMERA

When your schoolbook said that the human eye is like a photographic camera, it used a comparison 400 years old and never bettered yet. A globular camera, set in a socket of bone, aimed at its object by a set of six muscles, with the lens hole in the segment appearing between the eyelids. Its lens is, surprisingly enough, called a lens, and its iris, which regulates the amount of light that enters, is called an iris.

Instead of film at the back, it has the retina, a photo sensitive screen which passes on light and shade and color to the optic nerve. Instead of a bellows to alter the focal length, it has a round muscle, ciliary by name, which by contracting and expanding increases and decreases the curvature of the lens—which in turn alters the direction of the rays of light passing through the lens.

There are other gadgets which you couldn't find in your little brother's box camera, but that is as technical as we need get.

The ciliary muscle is strong for its size, but apt to rebel when imposed upon. Modern life is a big imposition to begin with, for the muscle has to start work whenever you're looking at anything nearer than 20 feet. The unfortunate fact that there is something screwy about the construction of four pairs of eyes out of five makes a lot more work for the muscle.

Near-sightedness, which the oculist calls myopia, is one kind of screwiness; far-sightedness—hyperopia, and astigmatism are others. Clear sight requires the lens to bulge so that the light rays entering the eye are sharply focused on the macula, the hypersensitive spot on the retina where alone you see clearly in detail.

Your remote descendants' Cyclopean eye, by the way, will probably have two maculae, to enable him to see three dimensions.

A far-sighted eye is made too short from lens to retina, so the ciliary muscle has to work overtime to focus the eye on nearby objects. Children are born naturally far-sighted, before the muscle gets into its stride. Most people beyond 40 are booked for far-sightedness again, a kind known to the oculist as presbyopia, produced by the lens getting old, stiff, and lazy.

Grandpa, you remember, could see farther and more clearly than you, although he always had to wear reading glasses for the evening paper.

Near-sighted eyes are too long from lens to retina, in some cases out of sheer cussedness, in others because the wall of the eye has weakened and allowed it to flatten like a rubber ball squeezed in the hand. Unless proper precautions are taken, distortion of the shape of the eyeball may eventually cause the retina to break away from the wall—and that means blindness.

ASTIGMATISM

In astigmatism, either the lens or the corusa—the transparent window over the pupil—has a flaw in it which plays up with the light rays, just as a flaw in a window glass distorts the view inside. You can have astigmatism along with either near or far sightedness. You can also have another complication, known as "muscular imbalance"—faulty co-ordination of the muscles which aim the eyes at their objects, often resulting in a squint or cross-eyes, and seeing double.

The examiner's job is to discover how many of these faults your eyes manifest and how much of each, and design a pair of lenses to juggle the light rays before they enter the eye in such a fashion as to make up for your natural handicaps.

Near-sightedness calls for concave lenses to shove the focus backward and take some of the strain off the ciliary muscle; far-sightedness, conversely, for converse lenses to pull the focus forward.

Astigmatism is corrected by a lens ground on the cylindrical principle which sorts the light rays out into their natural relation. And those are the general principles of what the profession calls "errors of refraction."

And errors of refraction are only the beginning of the story. Medicine has recently become aware of a strange complaint called anseikona, which makes the same object appear smaller in one eye than in the other—they are not yet quite sure what to do about it.

OTHER AILMENTS

Glancoma is a sinister complaint in which the eye's plumbing arrangements get clogged, so that the pressure inside the eyeball mounts up, eventually, if proper treatment is not given, destroying the retina, working in from the circumference to blot out the macula in the centre.

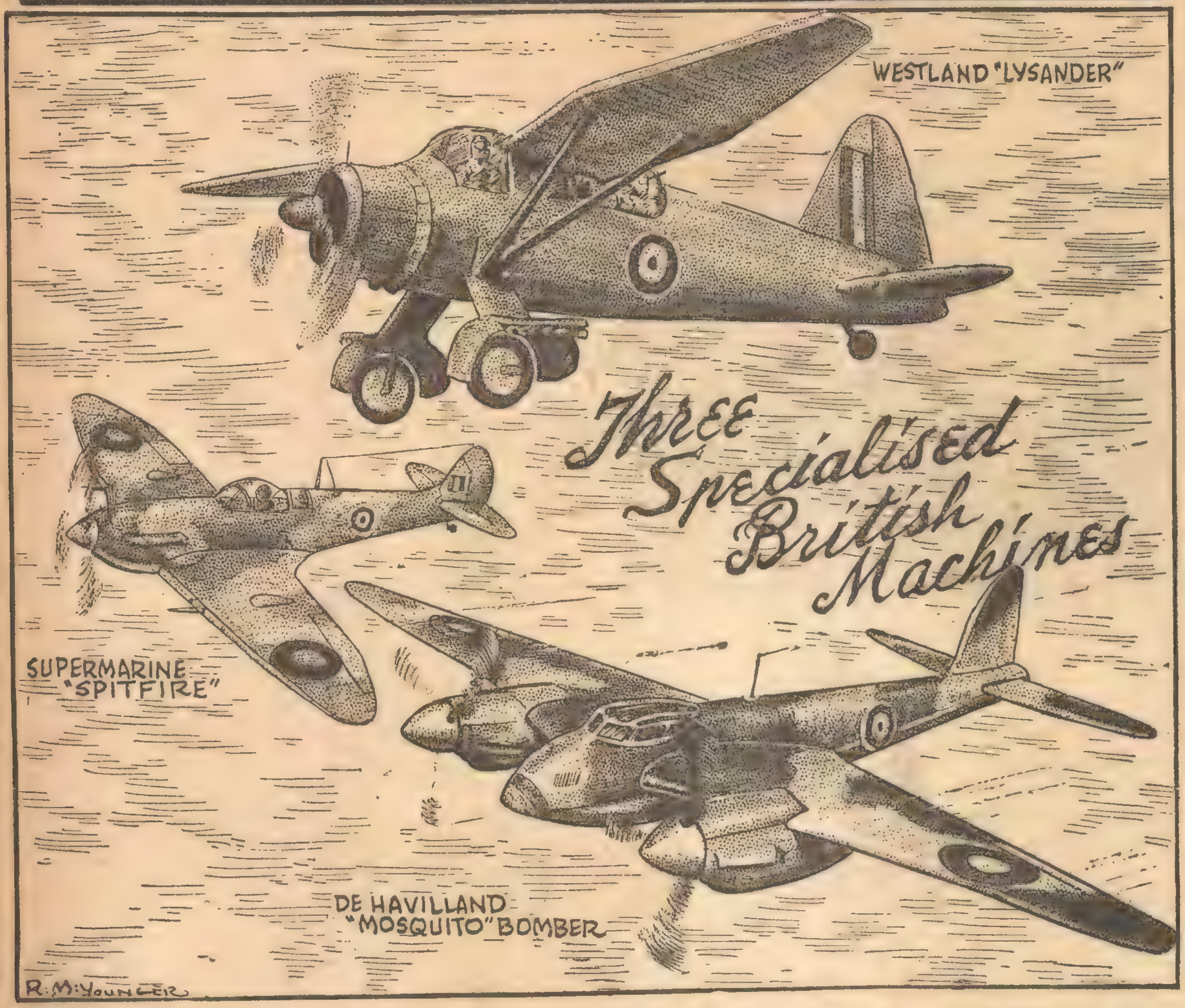
And the intemperately heavy drinker and heavy smoker is always living under the shadow of amblyopia, which kills part of the optic nerve, which is another avenue for approaching blindness.

Asking the chemist to take a cinder out of Johnny's eye is something the eye doctor regards with open-mouthed amazement. The cinder is probably sharp, and a toothpick wrapped in cotton-wool, the instrument generally used, is better calculated than almost anything else to drag the cinder along

(Continued on Page 52)

OWNERS of dual-wave battery receivers are often puzzled at the partial or complete failure of their receiver on the short-wave band. On page 29 of this issue, the technical editor discusses the particular difficulty and suggests ways and means of overcoming it. The same article gives an up-to-the-minute circuit for a 5 valve D/W battery receiver.

AIRCRAFT OF TODAY — BY R. M. YOUNGER



Not only the newest in aeroplane designs are good; many older designs have special value in the particular styles of work for which they were produced.

TWO of the British machines sketched above are in the latter category. The third is the smashing new bomber, the Mosquito, which was "hush-hush" until recently.

Sketched at the top is the only high-wing monoplane supplied to the RAF in large numbers in recent years—the Westland Lysander, which, though superseded as a front-line plane, is still playing a valuable part in specialised Army co-operation work. It is one of Britain's good pre-war designs.

The main reason for the high-wing arrangement is that in an Army co-operation aircraft it is essential that both the pilot and observer have an unobstructed view in both a forward and downward direction. With a high-wing, there is no downward blind spot.

However, a retractable undercarriage is impossible or, at best, very cumbersome with a high-wing design, so the Westland designers decided to make use of the undercarriage. Machine-guns are situated in the wheel fairings, and bomb-racks are carried on the wheel fairings by bolting small stub wings to the spats.

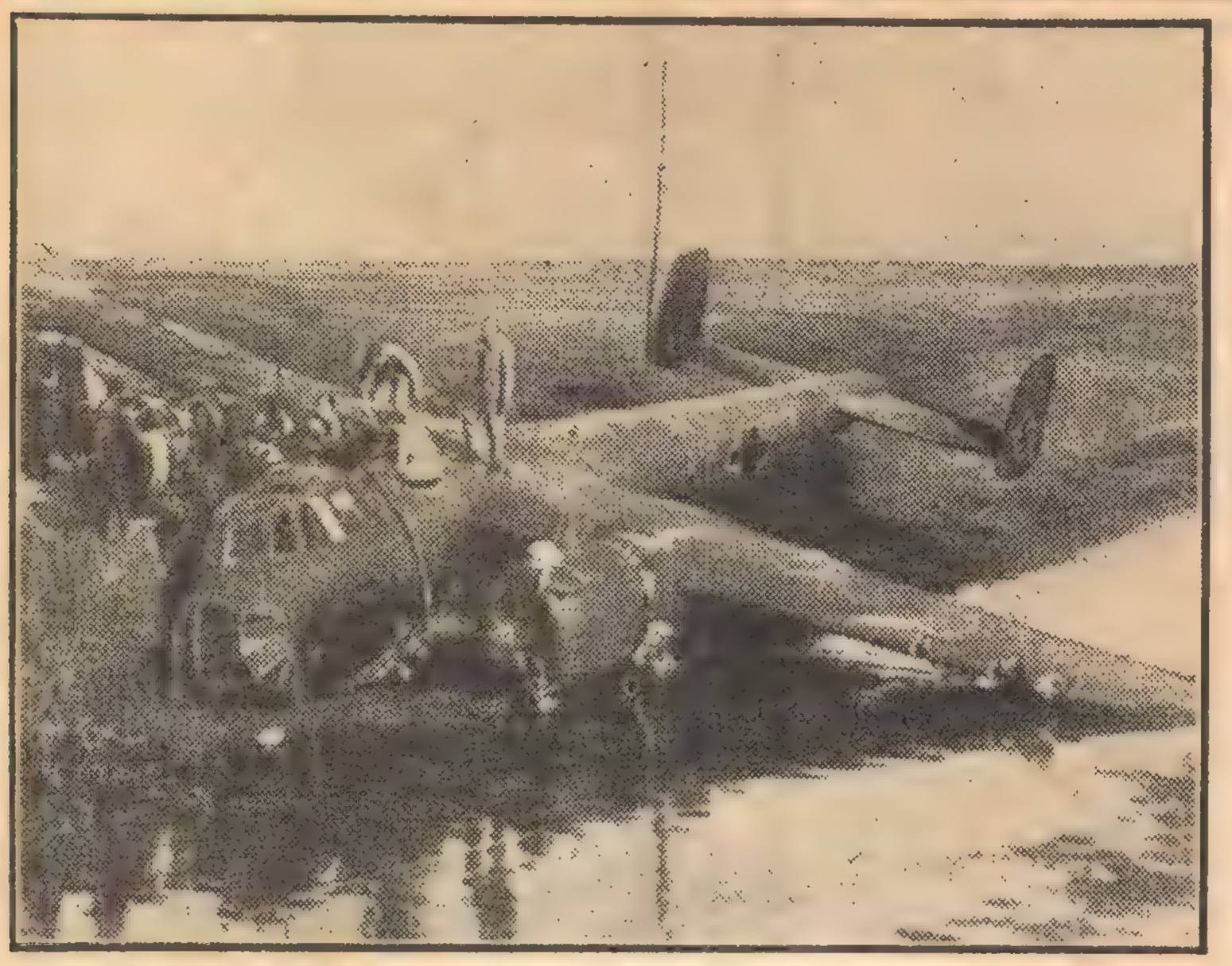
With the more powerful engines put into later models, these planes are said to have a speed of over 250 mph and a range of 600 miles. The take-off run is only 165 yards and the landing speed 55 mph—a remarkable speed range of nearly 5:1. Wing-flaps also give a remarkable angle of climb. The leading edge of the wing is slotted. The observer's position is fitted with a movable gun.

At the left centre is a Supermarine Spitfire. The Spitfire design is so fundamentally sound that, by the use of more powerful engines, heavier armor, and greater fire-power, successive developments of it, produced from time to time, are more than a match for newer enemy designs.

The Spitfire 5-C was first used in combat several months ago. It has a speed of over 370 mph. Its cannon permit the machine to engage an enemy at 700 yards, compared with the 400-yard range of earlier models. The calibre of the cannon exceeds that of the Focke-Wulf 190, Germany's latest and most powerful fighter. This model

(Continued on Page 52)

FULL DETAILS OF THE DORNIER 217E



A Dornier 217E photographed shortly after being shot down over England. Examination of such wrecked planes allows aircraft engineers to obtain a very good idea of the performance, even without reconditioning. Armament is revealed, as also are any new methods of construction, or secret devices which the plane may incorporate.

Under pressure of their Nazi warlords, German plane designers have managed to turn out some fine aircraft. Unfortunately from their point of view, the designers of the United Nations have been no less keen and have managed, so it seems, to keep a jump ahead of them in most respects. One of the most interesting of the later German planes is the Dornier 217E, a versatile medium bomber.

SOON after their first appearance over Great Britain, some months ago, several of these Dornier planes fell victim to that country's aerial defences, and were captured in fairly good condition. Subsequent examination has revealed to British engineers many interesting points of design, as well as permitting the general performance to be assessed.

The following information, compiled from "Aeronautics" and other English sources, is rather more detailed than is usual for "Radio and Hobbies," but nevertheless makes interesting reading, even for those who do not boast any deep technical knowledge of aircraft or aircraft construction.

The Dornier 217E is a development of the older Dornier 17 "Flying Pencil" and the Dornier 215, the prototypes of which appeared respectively in 1936 and 1938. However, this newer plane incorporates many structural differences.

The Dornier 217E is a high-wing, twin-engined monoplane with twin fins and rudders. It has a span of 62ft. 5in., and overall length of 56ft. 6in., and a height of approximately 15ft.. All-up weight is 33,500lb.

Although generally referred to as a medium bomber, the Dornier 217E has, in addition, been designed with a view to possible use as a dive-bomber. It may also be used as a torpedo aeroplane and for mine-laying.

The bomb cell is normally 14ft. 10in. long, but there is an extension, which may be utilised when a torpedo is to be carried. Alternatively, there is sufficient room to house two mines.

For purposes of bombing, approximately 5550lb. of bombs may be carried internally within the bomb bay. A further 1150lb. of bombs can be carried externally, slung under the wings.

The fuselage is of unusually small cross-section from near the leading edge of the wings to as far back as the tail. The crew of four are grouped together in a cabin at the front of the fuselage. This follows what is quite common German practice, and is similar to the arrangement of the older "Flying Pencil."

THREE-SECTION FUSELAGE

The fuselage is built in three sections and each part attached to the next by means of about two dozen bolts, which pass through flanges. The covering of the fuselage is stressed skin, with Z-section and T-section stringers. The wings are also in three sections.

The centre section, with a span of 29ft. 5in., is built integrally with the centre section of the fuselage. The ailerons have balance-cum-trimmer tabs, and split flaps, which are electrically operated.

The tail-plane has adjustable incidence, and this is changed electrically and simultaneously with the flaps. The elevators are fitted with balance-cum-trimmer tabs and are electrically operated. All the controlling surfaces are metal covered.

A particularly interesting feature of the tail unit is a fixed Handley-Page slot along the leading edge of each fin. Presumably, this arrangement has been adopted to prevent the fin from stalling, with resulting overbalancing of the rudder, should the aeroplane be thrown into a violent sideslip or flown with one engine out of commission. The rudders have trimmer tabs right along their trailing edges and are mass-balanced with a weighted horn.

WING CONSTRUCTION

The wing construction of the Dornier 17 embodied two Warren girder spars and the span was 59 feet. The Dornier 217 wings are of different design and, as has been stated, are built in sections. There is no dihedral on the upper surface, but, as is the case with the earlier type, there is 1.8 degrees in the centre line.

The electrically operated flap mechanism is extraordinarily complicated. The flaps and the ailerons are interconnected so that the later droop when the former are lowered. When this is done to the fullest extent the angle is 55 degrees.

The main structure of each wing section consists of two spars and these have T-section flanges. The centre section of the front spar has a double lattice web and the rear spar has a solid

(Continued on Page 12)

by *Aerofoil*

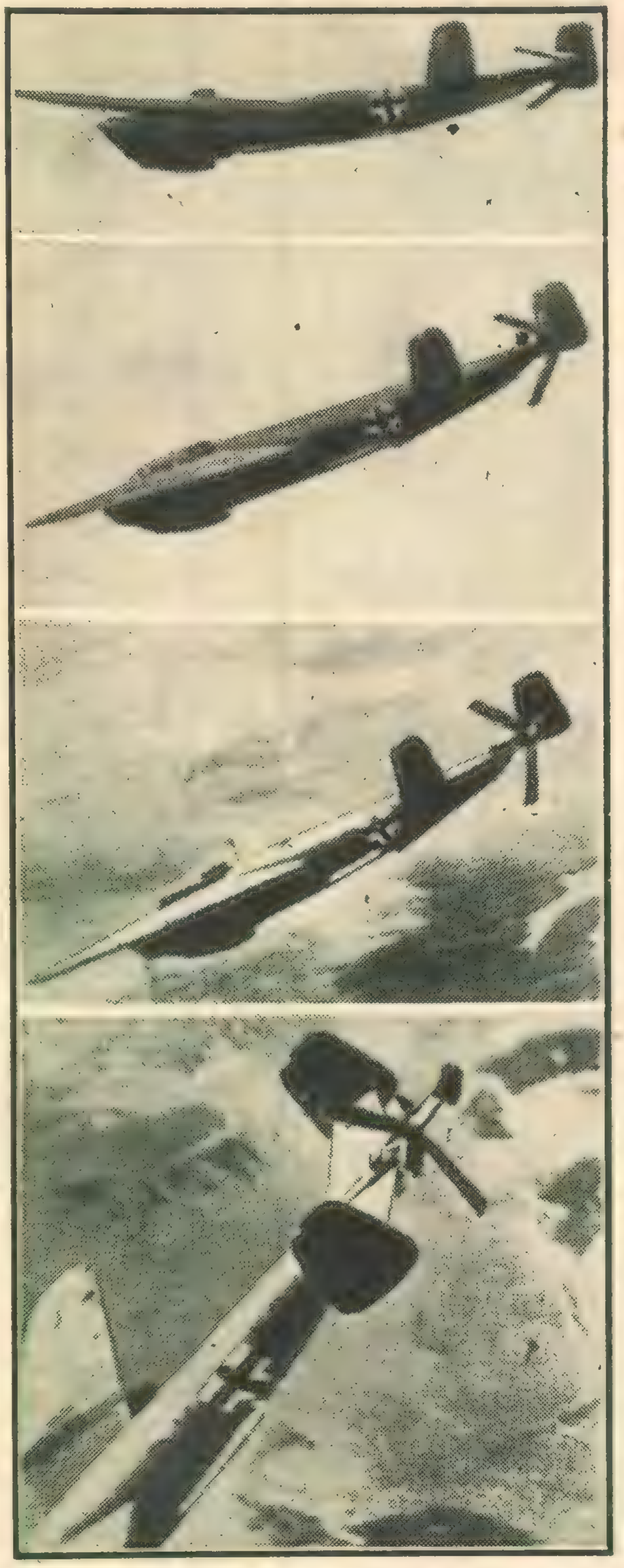
GERMANY'S VERSATILE MEDIUM BOMBER

DORNIER 217E

Scale (approx.) 1in.—10ft.

Span	62' 5"
Length	56' 6"
Height (approx.)	15' 0"
Mean Chord	9' 9"
Aspect Ratio	6.4
Dihedral	1.8 deg.
Sweepback	1.0 deg.
Wing Loading	59.4lb.
Weight	33,500lb.
Max. Speed	308 mph.

SHOWING THE DIVE BRAKES IN ACTION



The accompanying pictures are not very clear but they nevertheless give a good idea as to the manner in which the dive brakes operate. It would appear that, in normal flight, the vanes, together with an end piece, fit snugly together to complete the lines of the fuselage. To unfold, the end piece slides backward and internal levers push the four vanes outwards at right angles to the fuselage. Electrical circuits provide auto-automatic operation for dive bombing.

lattice web and the rear spar has a solid plate web. The outer sections are made of lattice web and there are T-section bracing members. The span is 62 feet 5 inches and the wing area is 610 square feet.

In the general arrangement of the engine mountings welded steel tubes are adopted, and these are attached to fittings on the front spar through the medium of four spherically seated joints. The mounting blocks are rubber bushed.

The undercarriage legs, which are of orthodox double-Oleo pattern, retract backwards into the engine nacelles.

Movement of the ailerons, like that of the rudders and elevators, is effected mainly by rods and levers.

Altogether there are five fuel tanks, all disposed in the wings. They have the usual German rubber-leather protective covering, and the total capacity is 650 gallons. The tanks are fitted between the spars and there are two oil tanks, which are also housed in the wings, outboard of the engines.

A feature of this product of Dornier Metallbauten G.m.b.H., is the de-icing equipment. For the wings a hot-air system is employed. Attached to the leading edge there is a large lagged pipe which is supplied with hot air from tween the spars and there are two oil tanks, which are also housed in the muffs, which are arranged around the engines' exhaust pipes.

Ducts carry the hot air into the small space which exists inside the double-walled leading edge and it passes out of the wing through apertures near the aileron hinges. Flap valves actuated by wires and a control lever in the cockpit provide a means of adjusting the hot-air flow.

No provision is made for countering ice formation on the tail-plane and fins and the aerial mast is also unprotected. But the airscrews are fitted with slinger rings, which distribute a fluid consisting of 40 per cent. Glycol and 60 per cent. industrial alcohol over the blades.

1500 H.P. ENGINES

The engine used in the Dornier 217E1 —the first version of the 217E—is the BMW 801A. This is the 14-cylinder two-row air-cooled radial which appears to be ousting the liquid-cooled Daimler-Benz hitherto so much in favor with the enemy.

For its rated power and considering the auxiliaries which it carries, this engine is remarkably compact. The designers have plainly aimed at cutting down the frontal area by every possible means, but, in doing so, they have crowded parts and components so tightly that accessibility has been seriously sacrificed. For this reason maintenance and overhauls must be a formidable task.

The BMW 801A yields 1580 horse-power for take-off and 1460 horse-power at 16,300 feet. The supercharger is fitted between the crankcase and the rear auxiliaries gearbox, and fuel injection is employed. The cylinders have a single inlet and single exhaust valve, and these are push-rod operated. A Bosch single drive unit magneto serves two plugs per cylinder.

The cooling arrangements are of particular interest. The cylinders are closely baffled at the head and along the barrel, and the entire engine is covered with a long cowling, which has an overall diameter of four feet six inches.

Behind the airscrew there is a fan, which is geared up two and a half times airscrew speed. It has been found to give adequate cooling, especially at high revolutions per minute. As this forced-air cooling makes gills on the cowling unnecessary, and as it passes over an oil-cooler placed in the cowling it removes the need for an oil radiator. Thus, drag is appreciably reduced.

FORMIDABLE ARMAMENT

Armament of the 217E1 consists of one fixed M.G. 151 (15 millimetres), and seven 7.92 millimetre machine-guns. The 15 millimetre shell-firing gun is mounted in the lower port side of the nose, fires 250 rounds, and is operated by the pilot.

Two movable 7.92 millimetre machine-guns are arranged on each side of the cabin and can be fired through the windows, and there is a ventral-mounted gun and two which can fire aft.

Armor protection installed is mainly for the pilot. His seat has a curved shield 8.5 millimetres thick arranged be-

hind it, a five millimetres plate beneath it, and a five millimetres plate on the roof above. Two curved plates, five millimetres thick, are fitted on each side of the rear cockpit, and there is also a 8.5 millimetres bulkhead. This armorplate is made of silicon-chromium-molybdenum steel.

The all-up weight of the aircraft is estimated to be 33,500lb. and the wing loading is 59.4lb. per square foot. This and the power available points to the need for some form of assisted take-off, and this seems to have been adopted, for there is a nose hook, presumably for a wire cable, and a support for the rear end of the fuselage, and there are signs that rockets can be fixed to the wings.

ELECTRICAL CIRCUITS

The Dornier 217E is notable for the complexity of the electrical circuits. The whole of the mechanism for releasing bombs, torpedoes or mines is electrically operated. So also is the retractable undercarriage and the retractable tail wheel.

The MG 151 shell gun, the airscrews, and the de-icing equipment are all electrically controlled, or partially so. In addition, there are the interlocking flap and mil-plane controls and the usual lighting, radio, ignition and signal circuits.

Other unusual features, which involve considerable complication to the wiring, are the air brakes at the rear of the fuselage and a system of interlocking relays, which make it possible for the pilot to carry out dive-bombing operations almost automatically.

DIVE BRAKES

There is some contradiction and confusion between various descriptions of the manner in which the dive brakes operate. The photographs on the opposite page show clearly enough their general form and the position they occupy when open.

Some sources seem to suggest that the dive brakes are permanent equipment on all Dornier 217E planes. However, it seems more likely that they are in the nature of an accessory, fitted when circumstances require. The fitting should only require a matter of minutes, since it would appear that the whole assembly merely slips into place on to the end of the fuselage, the electrical control circuits being connected by means of a plug and socket arrangement.

The vanes are apparently of curved section and, when closed, continue the tapering lines of the fuselage. A tapering end piece completes the streamlining.

If necessary, the whole assembly can be jettisoned by operating a control in the cockpit.

AUTOMATIC BOMBING

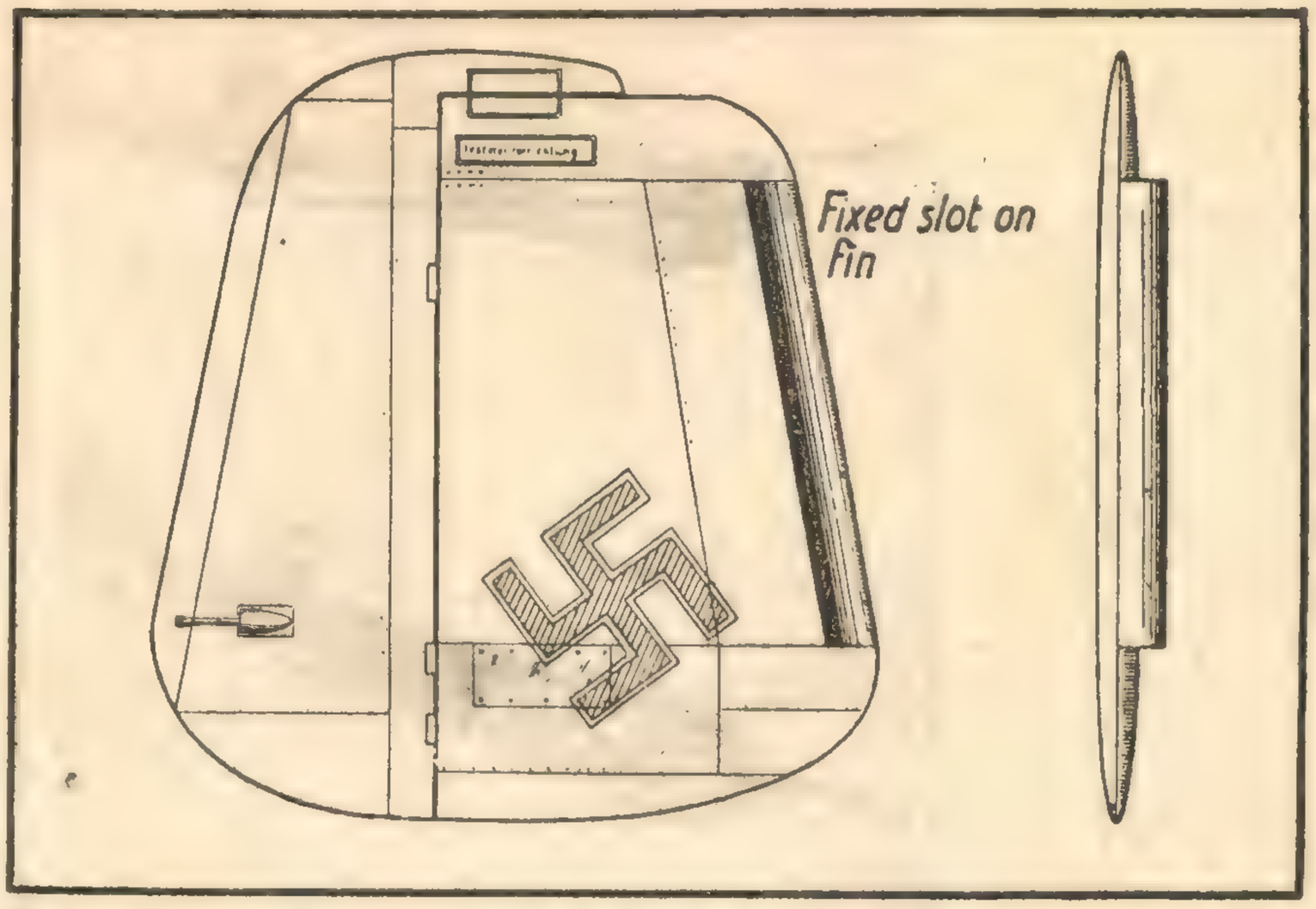
For operational flights not requiring dive-bombing tactics, the brake assembly may be removed and replaced by a streamlined fairing, which is somewhat shorter.

The automatic dive-bombing arrangement is particularly interesting. After the bombs have been selected, a bomb-fusing switch is shifted, whereupon the appropriate bombs are fused and the bomb doors swing open.

A second switch and then a button sets a timing circuit, shifts the elevator trimming tabs to place the aircraft into a dive and simultaneously pushes out the air brakes.

When the right moment is judged to have arrived, the pilot shifts the bomb release switch. Immediately the elevator trimming tabs return to their pre-set positions and the elevators moved upward to end the dive. A time delay circuit in the tail begins to operate, and this, in turn, actuates the bomb release mechanism. Immediately the last selected bomb leaves the rack a further circuit closes the doors to the bomb bay, after which the air brakes are retracted. Thereafter, the pilot takes full control to evade any anti-aircraft fire which may be encountered after completing the attack.

FIXED HANDLEY-PAGE SLOT ON EACH FIN

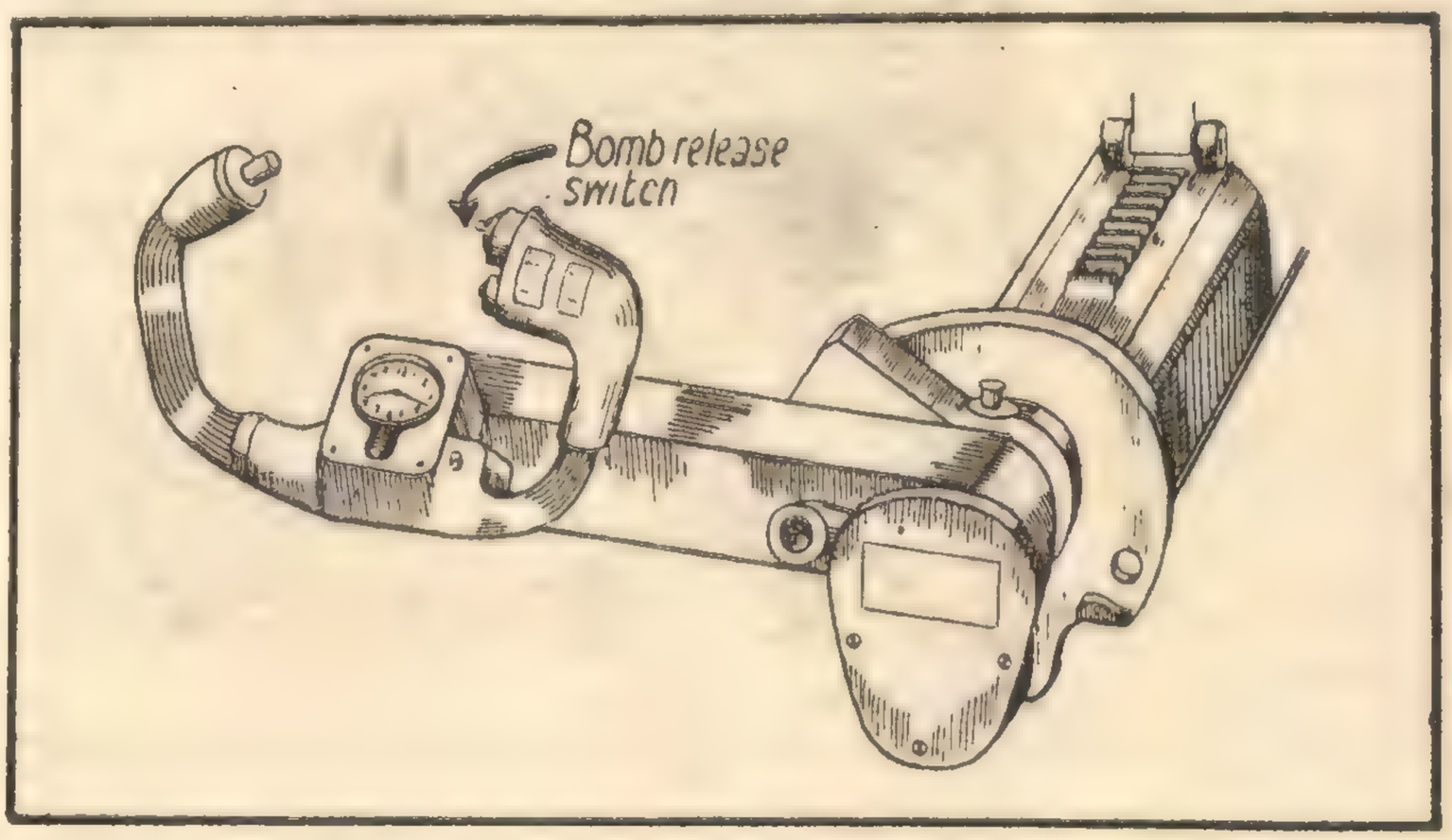


A rather unique feature of the 217E is the use of a fixed Handley-Page slot along the leading edge of each fin. Presumably, this slot is incorporated to guard against stalling of the fin as a result of the plane being thrown into a violent sideslip or flown with one engine out of commission. Note, also, the long extent of the trimming tab along the trailing edge of the rudder.

SPECIFICATIONS

Maximum speed of the 217E1 is estimated to be 309 mph. However, a newer and faster version has made its appearance. This is powered with BMW 802 engines, which are of 2000 horse-power and have 18 cylinders. This model has a gun turret and is said to have a maximum speed of 324 miles per hour.

Performance figures and dimensions of the Dornier 217E1 are as follow:— Maximum speed 309 miles per hour at 18,500 feet; range, 1500 miles at 19,100 feet and with 6615 lb. of bombs; initial rate of climb, 638 feet per minute; estimated unassisted take-off, 1550 yards. Dimensions: Span 62 feet 5 inches; height, 15 feet; length, 56 feet 6 inches; wing area, 610 square feet.



The control column in the 217E is unusual in that it is carried on a horizontal bar emerging from a point above the top of the instrument board. It may be swung right over to the opposite hand for use by the second pilot. A number of control switches are incorporated in the hand grips.

ITEMS OF NEWS FROM A WORLD AT WAR

U.S. Fighters In Action

MANY well-known US fighter planes are now seeing action on a large scale. First off the mark was the Tomahawk, which was used in the Middle East. The Tomahawk was superseded by the Kittyhawk, now in use in the Middle East and in the Pacific theatre. It is reported that a still later development, the Warhawk, has now seen action in th Solomons.

The Airacobra has fought in Russia and is being used to good effect in New Guinea. Lockheed's twin-engined Lightning has apparently proved a winner, to judge by its performance against Japanese fighters and bombers. The deadly Mustang is ranging over France, and the Wildcat is clawing down Jap planes in the Pacific.

Eyes are now turned to the Republic Thunderbolt, the heavy high-altitude fighter, which recently dived at 752 mph—faster than sound and faster than a .45 revolver bullet.

* * *

Aust. Record Glider Flight

IT is reported from Melbourne that Mr. Harry Bartram, of Station-street, Fairfield, an aircraft worker, recently stayed aloft in a glider for 7 hours 41 minutes at Mount Fraser. This constitutes an Australian record. The glider used for the flight was a 1937 model and of German manufacture.

GRUMMAN AVENGER TBF1

THE Grumman Avenger 1, officially designed as Grumman TFB1, made its debut at the Midway battle, where it scored successes against Japanese warships. The Avenger 1 has a short, stumpy fuselage; a raised cockpit enclosure houses the crew of three —the pilot, the radio operator undergunner and the top rear gunner in a "bubble" turret. The aircraft carries a 21in. torpedo inside the fuselage, enclosed behind bomb-doors under the mid wing. Alternatively, a bomb load of one-ton can be carried. Fitted with a 1600 hp Wright Double-row Cyclone engine, the Grumman has a top speed of 270 mph, and a range of 1400 miles at 215 mph. It has an overall length of approximately 34ft. and a span of 46 feet.

The "Singing Propeller"

THE problem of the "singing propeller" has been solved by Professor W. Kerr, of the Royal Technical College, Glasgow. The phenomenon was reported in a certain plane from the United States, the first of its class built for Britain. He discovered that the blade edges had a slight streamlining and, when this was rectified, the singing stopped

New Turret Proves Worth

A NEW power-driven gun turret recently enabled US bombers to shoot down 38 Axis aircraft without loss to themselves, says the "New York Times."

Used with a new gun sight, which makes it "almost difficult to miss," the turret permits the gunner to hold a steady aim in all circumstances.

"The turret represents an advanced phase of air armament.

"It is second only to the famous bomb-sight in making US aircraft supreme."

The new turret presumably represents an advance on the power turrets which have been fitted as standard equipment on British bombers for some years.

* * *

American Tubeless Tyre

FIRST nation-wide tests of tubeless tyres have proved successful, according to a recent statement by the Petroleum Industry War Council chairman (Mr. Boyd).

If the invention proves practical, it will add 200,000 tons of high-grade rubber in existing inner tubes to the nation's scrap pile.

The invention entails sealing the tyre casing to the wheel rim and installing a leakproof valve.

It was successfully tested for a week on 1000 motor cars, but the experiment will continue for a year.

* * *

R.A.F. Wrecks Philips Valve Works

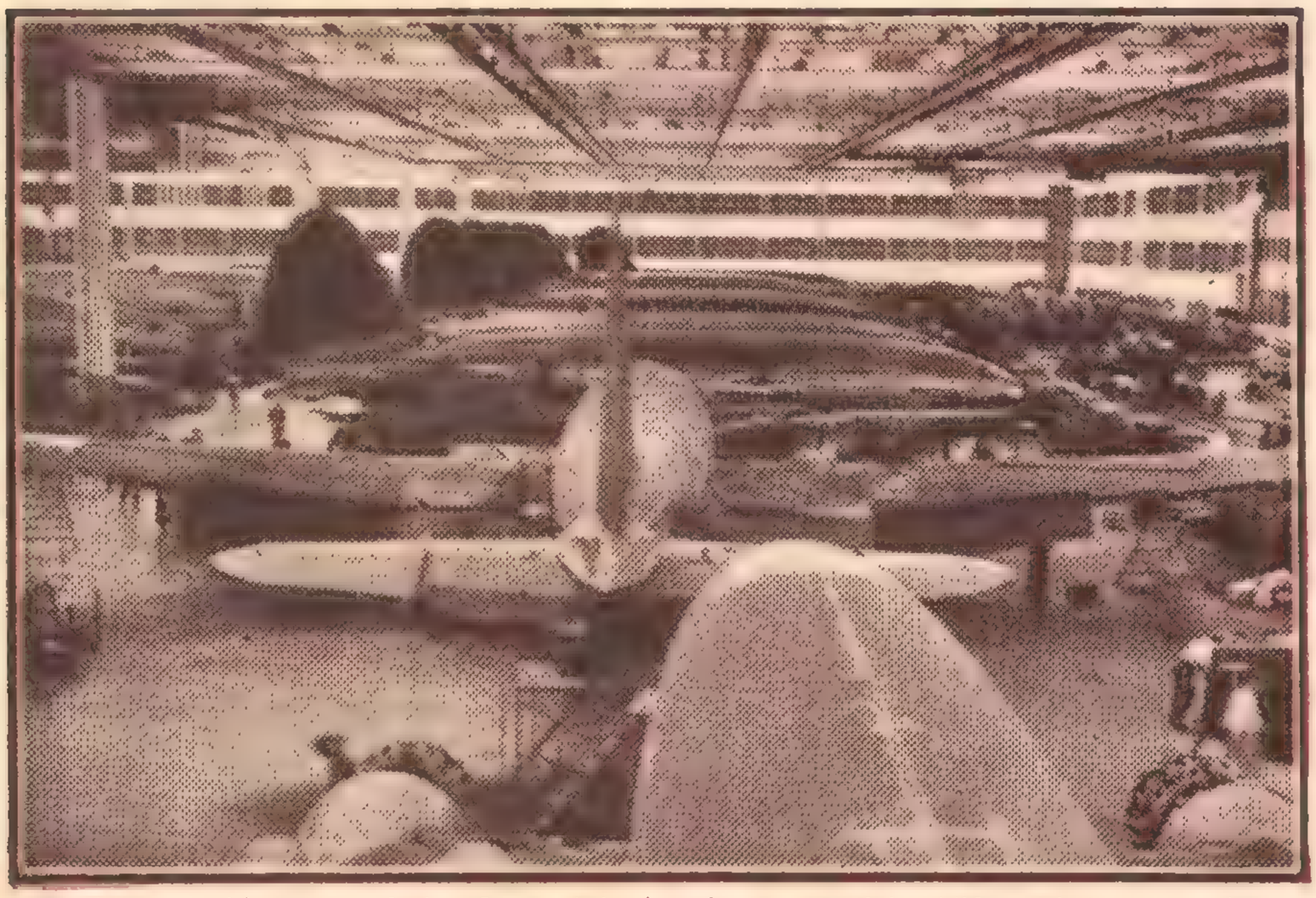
THE RAF has succeeded in damaging very severely the great Philips radio valve works in Eindhoven, Holland. The plant employed something like 15,000 workers and every valve made was going to the German forces. Reconnaissance pilots reported later that a section of the factory was completely gutted, that the roofs of all large buildings had collapsed, and that other portions of the works were still ablaze and being further shattered by internal explosions.

* * *

Fallen Leaves As Car Fuel

ACCORDING to a recent statement by the acting-general secretary of the NRMA, scientists in France are turning fallen leaves into charcoal briquettes, in order to eke out the allowance of motor fuel. The leaves are gathered from parks and woodlands and carbonised. Six hundredweight of carbon was obtained from one ton of leaves. It is believed that Australian gum leaves, which are rich in oil, would be more suitable for the purpose than leaves commonly found in France. At present, only wood is used in Australia for making fuel for gas producer units.

HUGE TRANSPORT PLANES FOR U.S. ARMY



In this assembly room of the Curtiss-Wright plant at Buffalo, NY, work is proceeding day and night on the construction of huge torpedo-shaped transports for the US Army. Designated as C-46, these planes are destined to speed paratroops, light guns, supplies and even Jeeps to strategic zones. The wingspan of 108 feet is about twice that of the Hawk series of fighters.

U.S. Gas Mortar

AMONG America's secret gas-war weapons is a chemical mortar which will fire 20 shells a minute, states Major-General Porter, head of the Army's Chemical Research Bureau.

If Hitler used poison gas, the US Army would be ready to give him an overdose of his own medicine.

* * *

Japs Using New Fighters

THE Japanese in China are now using two types of fighters superior to the Zero, according to Major David Hill.

Major Hill was formerly a squadron-leader of the "Flying Tigers."

One of the new Jap planes, the 97-2, is powered by a single engine and is considerably faster than the Zero.

The other, 1-45, is a twin-engined high-altitude plane.

It was first used for reconnaissance flights, but recently has been met as a fighter.

Even with heavier armament, it gives an excellent performance at high altitude.

* * *

New Weapons In Middle East

GENERAL MONTGOMERY used a secret mine destroyer at El Alamein as well as the secret anti-tank gun with which the Eighth Army is pursuing Rommel.

Wounded AIF men who have returned from the Middle East in a hospital ship said the mine destroyers played havoc with the thickly-packed German minefields.

Old Matilda tanks were fitted with apparatus to scoop up and explode the enemy mines, to clear a passage for the advancing infantry.

The men said Rommel's defeat resulted mainly from the greatest artillery barrage ever unleashed in the Western Desert, and the use for the first time of American-built General Sherman tanks.

* * *

Amphibian Tanks

NEW three-and-a-half ton tanks that can cross rivers are among the latest additions to Britain's armor. These machines are somewhat similar to the well-known Bren-gun carriers, but they are so constructed that they can plunge into a river, cross to the other side, crawl up the bank and go straight into action against the enemy.

* * *

New Faces From Celluloid

A METHOD of rebuilding faces with celluloid under the living skin is reported by Tulane University School of Medicine.

The new faces are said to look "as good as new." They last a lifetime.

Celluloid is moulded to the form of the missing contour and is fixed in place by sewing it to the underlying tissues.

Living skin taken from another part of the body is grafted to cover the celluloid.

ANOTHER LIBERTY SHIP GOES TO SEA

One answer to Germany's U-boat campaign is the Liberty ship—mass-produced freighters to replace losses and to carry vital arms and supplies to the far-flung Allied battle fronts. Our picture shows the captain of a new ship making a final check of the magnetic compass.

R.A.F. Parachute Bomb

IT is revealed that the RAF is using a new-type "parachute bomb" in raids on Germany.

The bomb, weighing about 2000lb., produces a powerful blast.

Its "parachute" is a cap covering one end.

The cap steadies the bomb and stops it from attaining such a high velocity that it buries itself in the ground, thus losing some of the blast effect.

ALLIES USING "FLOATER BOMBS"

IT has now been revealed that the Allies have, for some months, been using a special type of "floater" fragmentation bomb in New Guinea. The bombs are equipped with miniature parachutes to retard the speed of their fall and are dropped from aircraft flying at altitudes as low as 60 feet. They are so delicately fused that the relatively small impact with the ground explodes them. They have achieved an amazing record of accuracy against stationary targets and their fragmentation characteristic has caused extensive damage, especially to grounded aircraft and personnel. The Allied Air Chief (Lieut.-General George Kenney) who has spent seven years developing the bomb, has been awarded the Purple Heart in recognition of the results achieved.

Australian Locos In Iran

LOCOMOTIVES and waggons released by the New South Wales Railways are helping to carry war materials for the Soviet across Iran.

Between them, the Commonwealth and New South Wales Governments released 63 big locomotives and 835 waggons for use in Iran.

The Australian equipment has been working on the 1000-mile long trans-Iran railway since early this year.

It is rolling over rails and sleepers which Germany sent into Iran, and which the Allies seized in July.

* * *

Shipbuilding Methods

UNDER pressure of war, new methods of building ships are constantly being evolved. At one US shipyard, one tanker and three-quarters of another tanker are being built on the same slipway at the same time. The new ships, tankers of a secret type, are launched bow first. As fast as one ship is launched, the partly completed second tankers slides down a bit farther and its prefabricated bow is welded on. In the space vacated, work starts immediately on a third vessel. Work in US shipyards generally has speeded up to such an extent that the launching rate is now nearly four vessels a day.

Admiral Land, chairman of the Maritime Commission, has announced that a new type of Liberty ship, bigger, faster, and less vulnerable to submarine attack, would be in production shortly.

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AUDIO FREQUENCY TONE COMPENSATION

A NEW CIRCUIT FOR EXPERIMENTERS

The general subject of Audio Frequency Compensating Network is one of vital interest to all amplifier enthusiasts. The following is taken from an article by Stanley Cutler in "Electronics." The compensating network evolved by the writer provides continuously variable bass and treble boost by means of a simple resistance-capacitance network.

READERS will remember that a universal tone control unit was described in the September, 1941, issue of "Radio and Hobbies" and applied to an amplifier in the November issue of the same year. Although versatile, the particular scheme has the disadvantage that it utilises a special choke—an item which requires a quantity of hard-to-get wire and which is rather prone to pick up hum.

A further point is that the unit employs switches, which do not permit truly gradual adjustment of the tonal balance. These considerations limit the usefulness of the circuit for certain purposes.

Stanley Cutler discusses the general subject of compensating networks, and goes on to describe a circuit providing continuously variable bass and treble boost. Provision for bass and treble cut is assumed to be unimportant—an assumption which is valid for some applications.

The circuit, therefore, cannot be considered as superior to or supplanting the previously described unit. Both have advantages and disadvantages which make them more or less suitable for particular purposes. Here begins the article proper.

CASE FOR COMPENSATION

During the past several years it has become increasingly clear that a flat response does not necessarily represent the ideal characteristic for an audio system terminating in an acoustic device such as a loudspeaker.

Certain inherent characteristics of the human ear cause the sensation of reproduced sound to seem more realistic when both the high and low frequency ends of the audio spectrum are boosted some fifteen or twenty db above the level of the middle frequencies. The actual accentuation desired varies with the type of programme material and with the average level at which it is being reproduced.

Various circuits have been devised to accomplish this. It is the purpose of this article to briefly review in a qualitative manner a few of the more popular circuits in use, at the same time pointing to the weak points of each. Finally, a circuit will be described which accomplishes the desired results with a minimum of complication and without the disadvantages of the preceding circuits.

SUGGESTED FIGURES

For most types of programme material a gradual low-frequency rise from 500 c/s to a peak of 50 c/s, of between 15 and 20 db above the 500 c/s level, is ideal. The high-frequency end may rise gradually from 1000 c/s, reaching a peak of between 15 and 20 db above the 1000 cycle level at about 6000 c/s. For wide-range systems it is desirable to obtain the maximum response in the 10,000 c/s region.

Figure 1 shows a circuit widely used in radio receivers and public address amplifiers. It depends for its operation on the fact that the gain of a vacuum tube voltage amplifier is—

$$\text{Gain} = \frac{\mu R_o}{R_o + R_p}$$

Obviously, if Ro is large compared to Rp, increases in Ro will have little effect on gain. However, in the regions where Ro is small in magnitude compared to Rp, changes in Ro will have considerable effect on gain.

R in Figure 1 has a small value compared to the plate resistance of the tube and determines the gain at middle frequencies. Parallel resonant circuits tuned to approximately the peak frequencies described earlier are inserted in series with R. The gain of the stage is maximum at the resonant frequencies. Variable resistors connected across the tuned circuits provide continuously variable control of the boost characteristic.

A major drawback of this type of circuit is the fact that, in order to obtain good linearity with commonly used pentodes and high-mu triodes,

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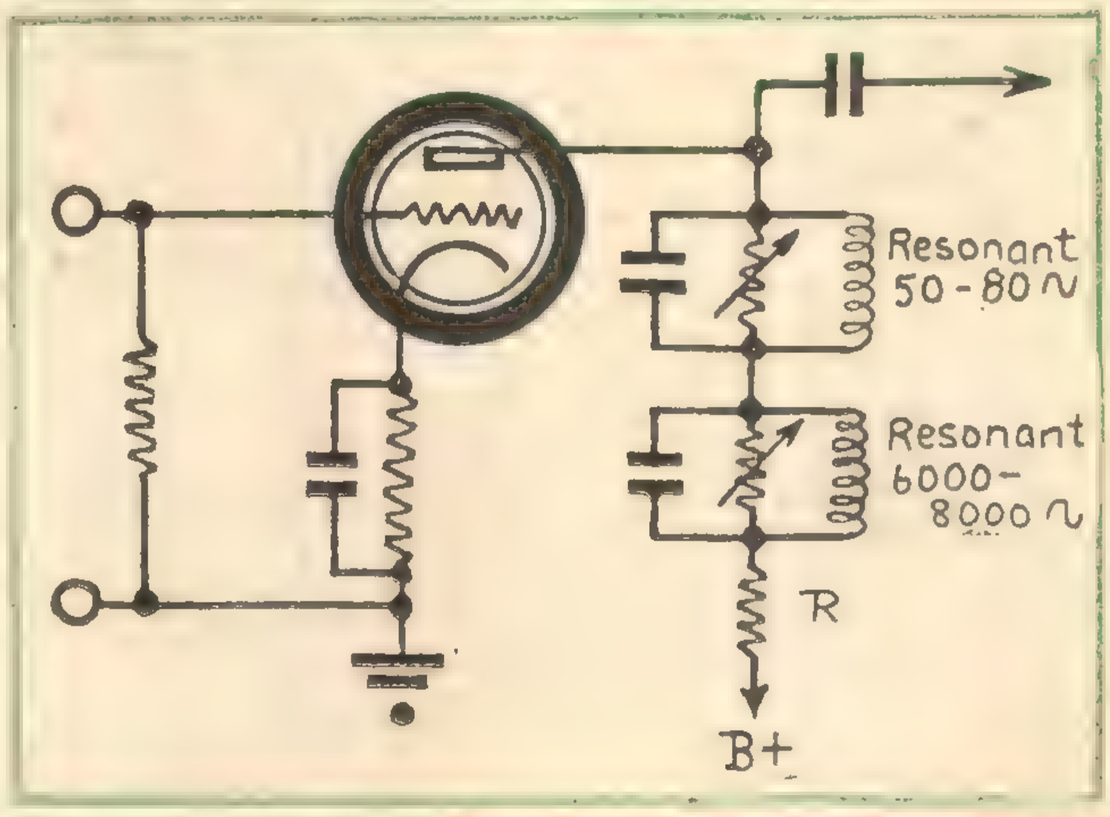


Figure 1. Bass and treble boost may be obtained by inserting resonant networks in the plate circuit of an amplifier valve. Apart from certain electrical disadvantages, the circuit calls for two special chokes, which may be expensive and difficult to obtain.

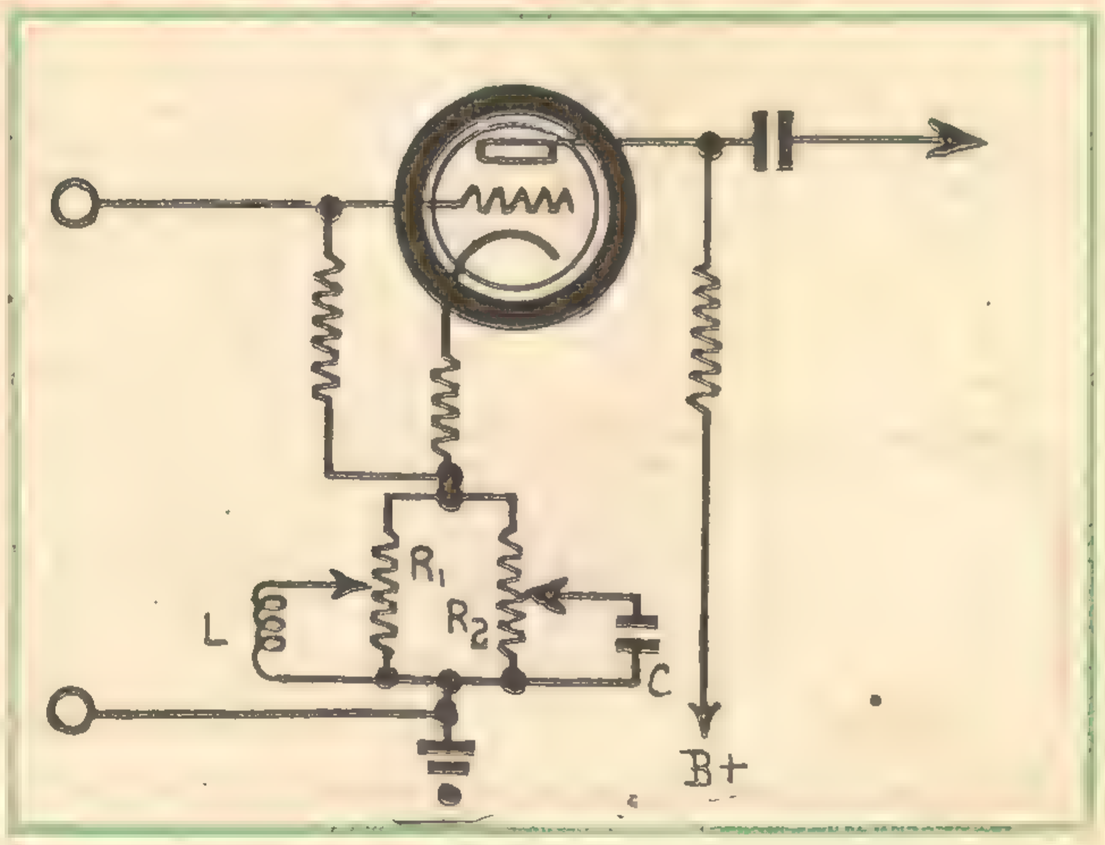


Figure 2. Another well known type of compensating circuit operating by virtue of degenerative effects in the cathode circuit of a vacuum tube. Although better in some respects than the arrangement in figure 1, it still has certain disadvantages, as pointed out in the text.

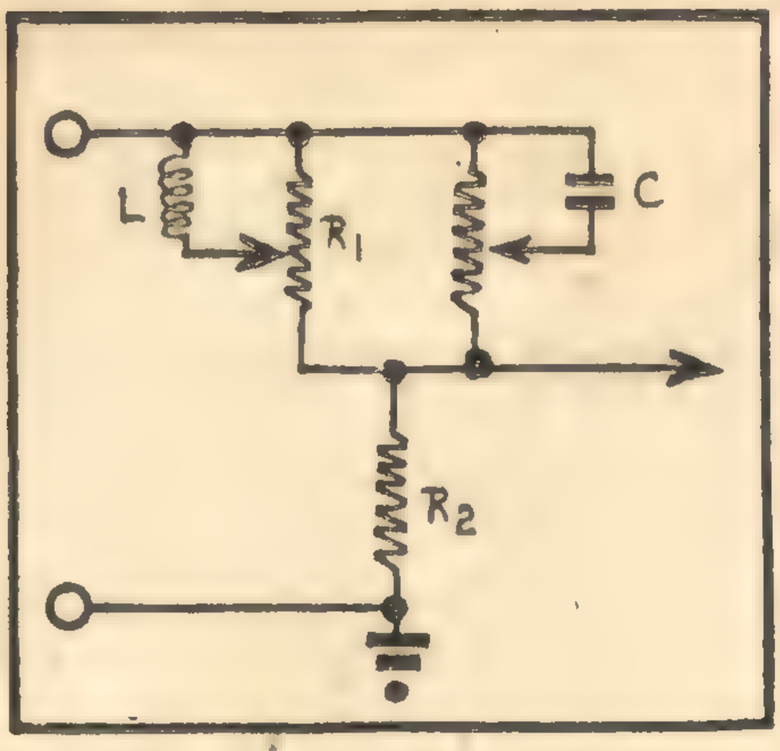


Figure 3. A compensating circuit which does not require the use of a vacuum tube, although its application is somewhat limited. The current through R2 at low and high frequency (and therefore the voltage developed across it) may be increased by shunting the control potentiometers respectively with L and C.

such tubes must be operated with inputs of not much more than one half volt. Since the gain at middle frequencies is practically nil, considerable amplification must be used after the circuit, and since the low frequency choke is quite large it is susceptible to hum pickup.

The low input voltage limitation also requires that some means be used to decrease the output voltage of most crystal pickups, which usually have in the neighborhood of two volts output.

DEGENERATIVE CIRCUIT

A more desirable type of circuit incorporates a fixed amount of negative feedback to establish the middle frequency level and employs some means of decreasing or removing feedback entirely at low and high frequencies. There are many variations of this type of circuit.

A typical one is shown in Figure 2. Here, feedback provides degeneration across R1 and R2, which determines the gain at middle frequencies. With L and C connected directly across R1 and R2, the feedback is decreased at low and high frequences respectively and the stage gain is consequently greater at these frequencies.

Since the inductance L is in series with the input voltage to the tube, here again a well shielded coil is usually necessary to prevent hum pickup.

Circuits of this type must also be designed carefully when using elements of a reactive nature, inasmuch as phase shifts may occur in sufficient degree to produce positive feedback at the extremely low and/or high frequencies, thus causing oscillation or unstable operation.

A simpler circuit, which does not involve the use of a vacuum tube to obtain the desired characteristic, is shown in Figure 3. Here the loss at middle frequencies in passing through the network is given by

$$\text{db Loss} = 20 \log \frac{R1 + R2}{R2}$$

Low and high frequencies are bypassed around R1 by L and C respectively. Here again hum pickup may be troublesome unless special precautions are taken in the design of L.

NEW CIRCUIT

A circuit was designed in an effort to eliminate the drawbacks of the foregoing methods. The most important principle of this network, wherein the necessity for the use of inductance is eliminated, is shown in Figure 4. At all frequencies above the frequency where the reactance of condenser C1 becomes small compared to the resistance of R2, the loss in passing through the network will be

$$\text{db Loss} = 20 \log \frac{R1 + R2}{R2}$$

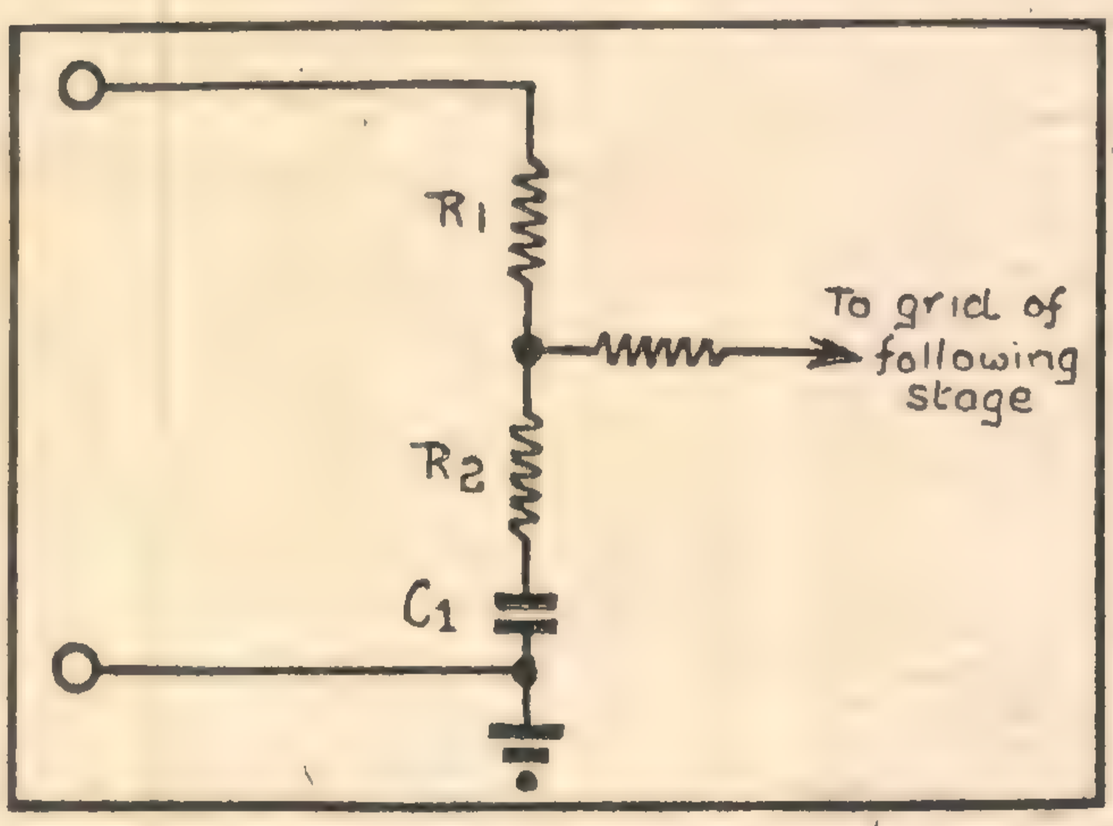


Figure 4. Basic network in the new circuit giving bass boost. At frequencies where the reactance of C1 can be neglected, R1 and R2 form a divider network, introducing a certain definite loss. At low frequencies, the reactance of C1 rises and a greater proportion of the input voltage reaches the grid.

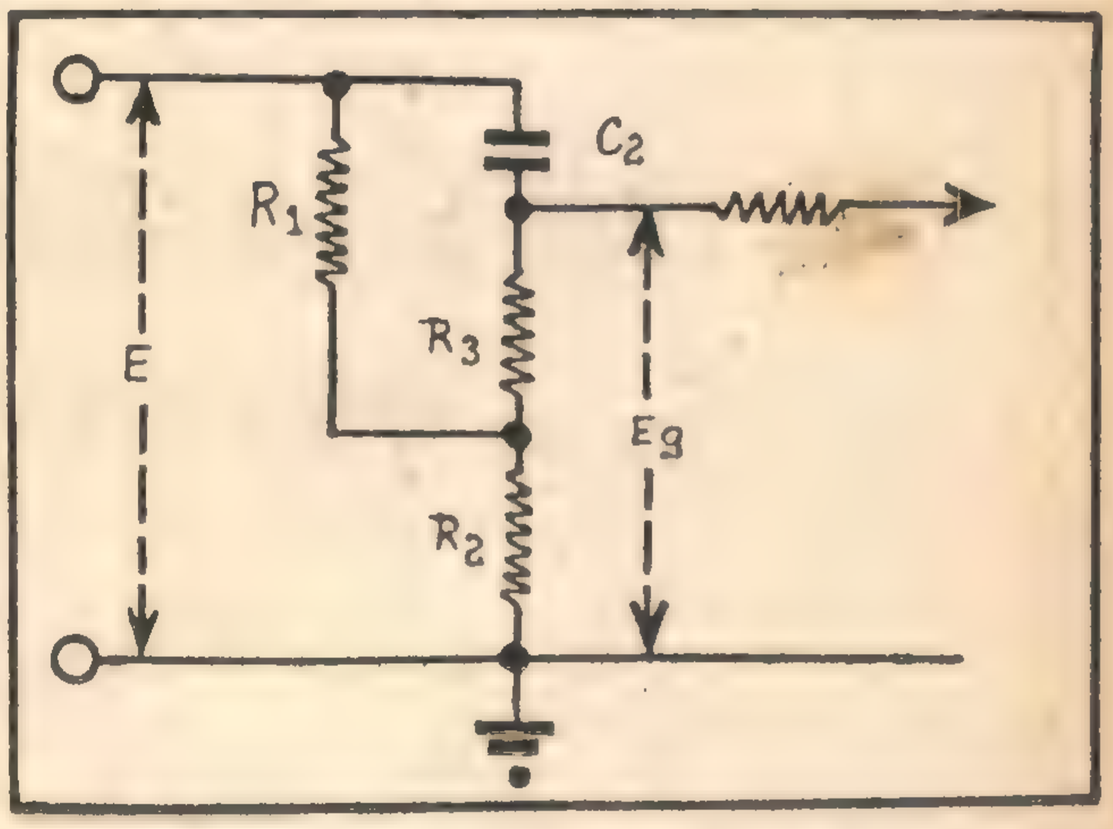


Figure 5. By adding the components R3 and C2 to the network shown in figure 4, it is possible to obtain a rising high note response, without in any way affecting the rising bass response. Combining figures 4 and 5 gives the complete circuit shown as figure 6.

Below this frequency the voltage applied to the grid of the following stage will vary inversely with frequency because of the increasing reactance of C1 and the networks loss at any low frequency will be

$$\text{db Loss} = 20 \log \frac{\sqrt{(R1+R2)^2 + \left(\frac{1}{\omega C1}\right)^2}}{\sqrt{R2^2 + \left(\frac{1}{\omega C1}\right)^2}}$$

To control the amount of bass boost it is only necessary to prevent the reactance of C1 from rising above the value necessary to produce the desired boost. This is accomplished by connecting a variable resistor, having a maximum value that is large compared to the reactance of C1 at the lowest desired frequency, across the condenser.

When the resistance is zero, the loss will be uniform at all frequencies. Between zero and maximum resistance, the bass boost will be continuously variable.

The equivalent circuit used for high frequencies is shown in Figure 5. If the network is operated into a very high impedance load, such as is presented by the grid circuit of a vacuum tube, the series arm R3 may be added without affecting the characteristics predicted in the preceding paragraphs.

Neglecting the effects of stray circuit and tube input capacitance and assuming the reactance of C2 is small compared to that of R3, as is usually true in practice, the voltage applied to the grid is given by

$$\frac{E_g}{E} = \frac{R1 \cdot R3 + R2\sqrt{R3^2 + \left(\frac{1}{\omega C2}\right)^2}}{(R1 \cdot R2)\sqrt{R3^2 + \left(\frac{1}{\omega C2}\right)^2}}$$

Since C2 is small, no appreciable high frequency boost occurs when it is connected to the junction of R2 and R3, instead of the grid. To provide continuously variable boost it is only necessary to make R3 a potentiometer, connecting the grid end of C2 to the variable arm.

The combined circuit, with suitable values, is shown in Figure 6. The overall response of this network when used in a wide range amplifier is shown in Figure 7.

FINAL CIRCUIT AND RESPONSE CURVE

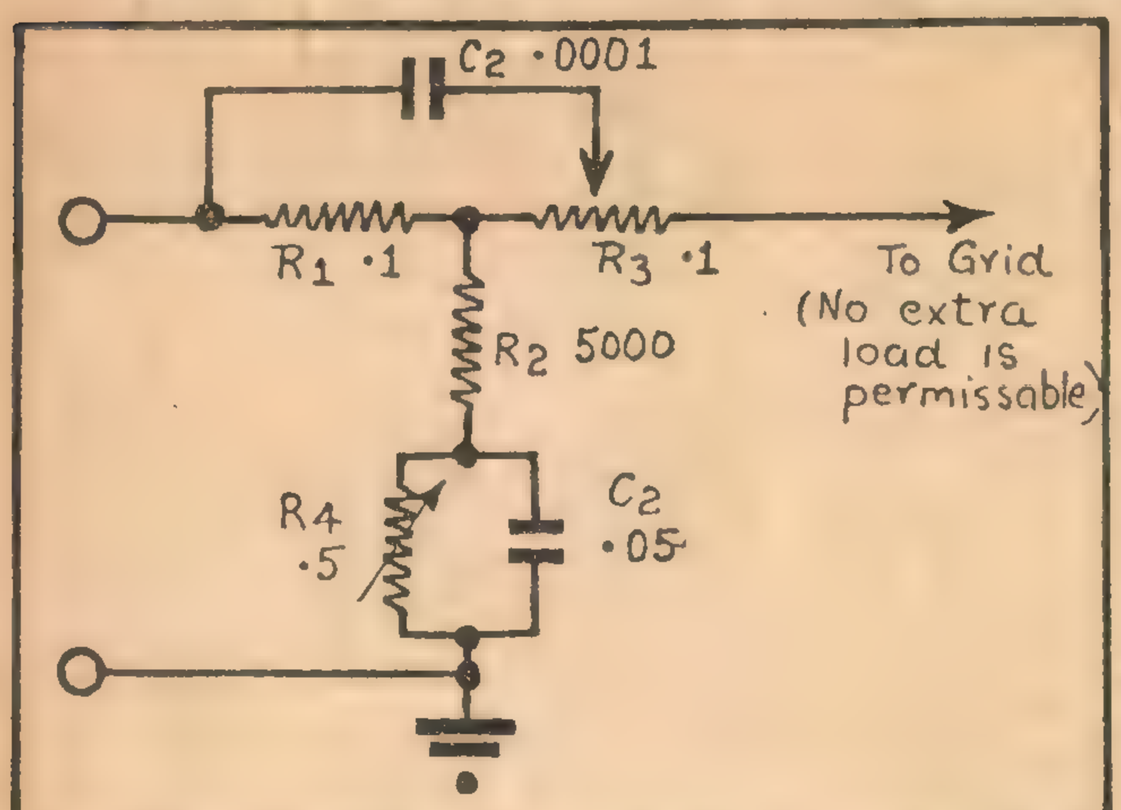
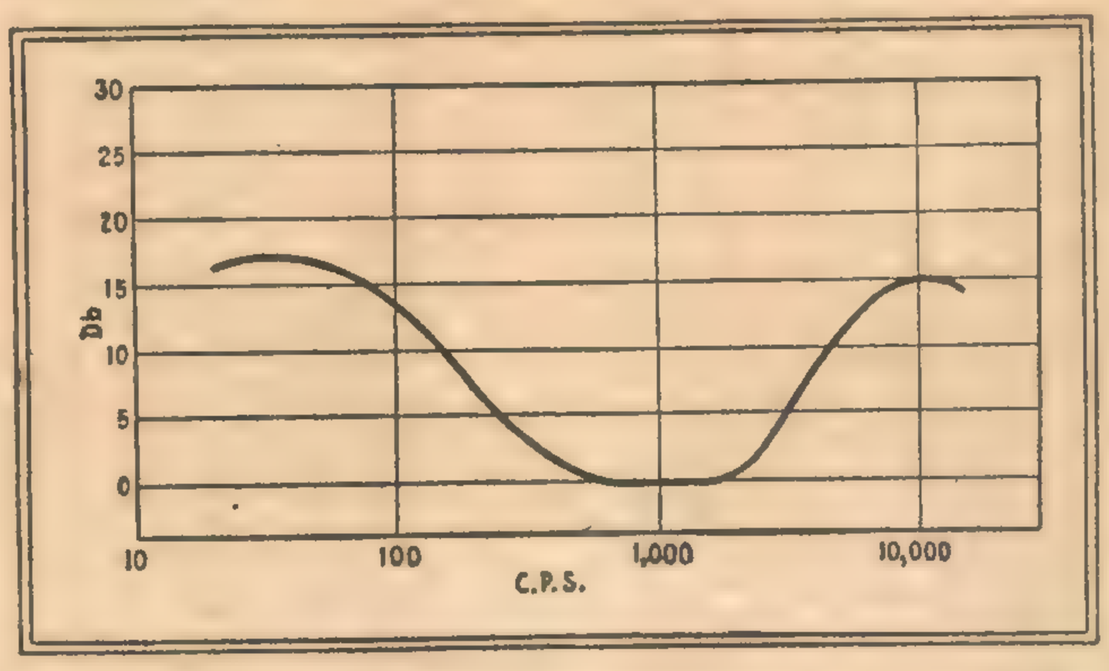


Figure 6, on the left, shows the complete network and figure 7 below the response curve with both controls at maximum. The circuit does not provide for bass or treble attenuation, but there are plenty of applications where this may not be considered necessary. Compare this with the Radiotron unit, the circuit of which is republished overleaf.



The curve was made with the controls set for maximum low and high frequency response. With amplifiers of limited range it may be necessary to increase the size of C2 in order to obtain sufficient rise at the upper frequency limit of the amplifier. Although a circuit of this type necessarily introduces some phase shift, it is not detectable by ear.

In conclusion, it is well to stress one point that is frequently overlooked in the design of audio systems with boost characteristics. In order to realise the full undistorted effect at the increased frequencies, the amplifier and reproducer must be capable of handling the comparatively high power that is necessarily expended at these frequencies.

For example, a loudspeaker of average efficiency requires about one quarter watt to deliver good volume in an average sized living-room. If twenty db boost occurs at the low or high frequencies, we have a power ratio of 100 or, in other words, 25 watts expended at these frequencies.

Although this may be somewhat more boost than would normally be necessary, it serves to illustrate forcibly the need for ample power. For systems providing a nominal increase of 15 db, the power capability should be at least eight watts undistorted power.

* * *

EDITOR'S REMARKS

As yet, we have not had opportunity to try out this circuit in practice. However, by reason of its comparative simplicity and the results claimed for it, it is well worth attention. We have taken the opportunity to republish the article for the benefit of those readers who may care to do some experimental work on their own account.

The compensating

(Continued on Next Page)

ADDING THE NETWORK TO AN AMPLIFIER

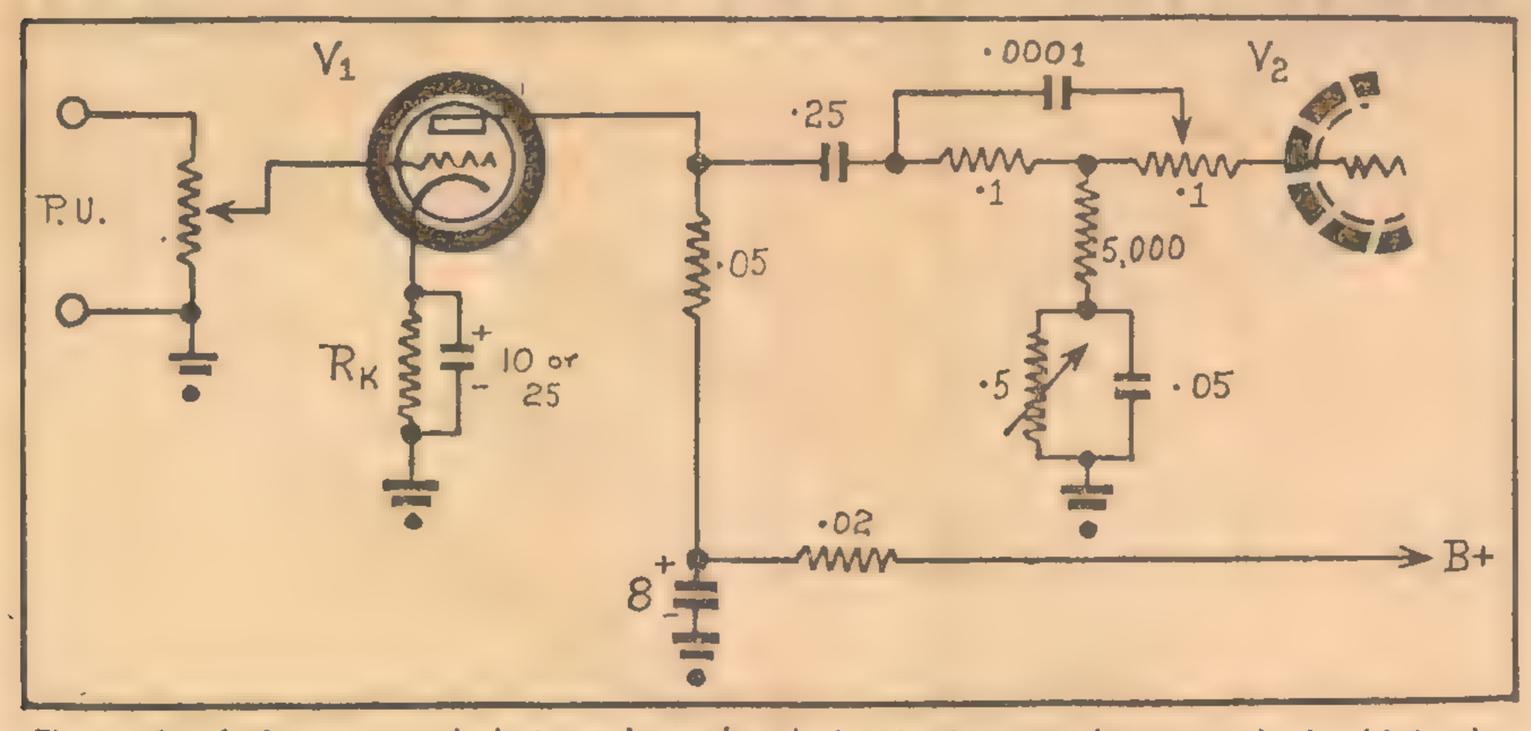


Figure 8. It is suggested that readers who desire to try out the network should hook it up as shown above. V1 is an additional medium-impedance triode connected directly after the pickup and feeding the first valve in the main amplifier. The value Rk is given by dividing the 50,000 ohm plate resistor by the amplification factor of the valve chosen.

network evolved by Cutler operates by virtue of the fact that it introduces a considerable loss in gain, means being provided partially to restore the loss at bass and treble frequencies. Thus the bass and treble are emphasised in comparison to the middle register.

In actual figures, the loss in figure 6 at middle frequencies is about 21 times, or 26.4 decibels. This is restored, according to the published curve, by an amount of 17 db. in the bass and 15 db. in the treble.

RESERVE OF GAIN

Because of the severe loss of gain incurred, the network could not be incorporated in an existing amplifier setup, unless the amplifier had a large reserve of gain. In other circumstances, the overall gain might be reduced to such an extent that it would be impossible to load up the output valves.

The published results are apparently based on the assumption that the input source has negligible frequency characteristics of its own, and that its output remains reasonably constant with small changes in output load. This condition is most conveniently met by the plate circuit of an ordinary low impedance triode amplifier stage.

Since the network introduces a considerable loss, it is suggested that the best plan is to add to the amplifying equipment an extra triode amplifier stage, using a valve such as a 6C5 or a triode-connected 6J7-G, which would just about make up for the loss of gain in the network.

EXTRA TRIODE STAGE

The pickup or equivalent input could be fed through a normal volume control to the grid of this extra triode stage, the frequency compensating network being connected in its plate circuit and feeding the grid of the next valve.

Note that the output of the compensating network must feed directly and only to the grid of a valve, without any additional coupling network. The connection of a grid resistor of any description in parallel with the output of the network may completely upset its operation.

The suggested arrangement is shown in the accompanying figure 8. It must be pointed out that this is merely a suggestion, which we have not yet had opportunity to try out. However, the setting up of the stage for experimental purposes is no great task, for all the parts required are of the type usually found in the parts drawer.

The valve V1 may be any ordinary general purpose triode having an amplifaction factor of between about 10 and 20 times. It would be in the nature of a preliminary stage, V2 being the normal first valve in the amplifier proper. The cathode resistor of the valve V1 may be calculated by dividing the plate load resistor, in this case 50,000 ohms, by the amplification factor of the particular valve chosen. The amplification factor may be read off from a valve chart.

Some readers may desire to try the effectiveness of the circuit when coupled directly between the pickup and the input to the first valve in the existing amplifier.

For this purpose, the pickup would have to be fed to the volume control, the input to the compensating network being taken from the variable tapping. The output from the network would then go directly and only to the grid of the first valve. It would be quite unsatisfactory merely to feed the output from the network to the input existing terminals and volume control, since the latter would form a parallel shunt across the output of the network and upset its operation.

POSSIBLE COMPLICATIONS

The idea of coupling the compensating network immediately after the pickup might introduce certain secondary effects, by reason of the fact that the network would constitute a variable and reactive load for the pickup.

The effect might not be very marked with ordinary magnetic types, since the load at middle frequencies at least would be near enough to the proper value. With a crystal pickup, things may be quite different. However, the network is simple enough and it is not a difficult matter to try it out for yourself in this application.

If a magnetic pickup with a built-in volume control is used, the output may be fed directly to the network. Where a separate control is desired, choose one of, say, 0.1 meg.

The usual load for a crystal pickup is 0.5 meg. In this case, a 0.25 meg. potentiometer might be used, with a 0.25 meg. resistor connected in series with the live lead from the pickup to make up the necessary value.

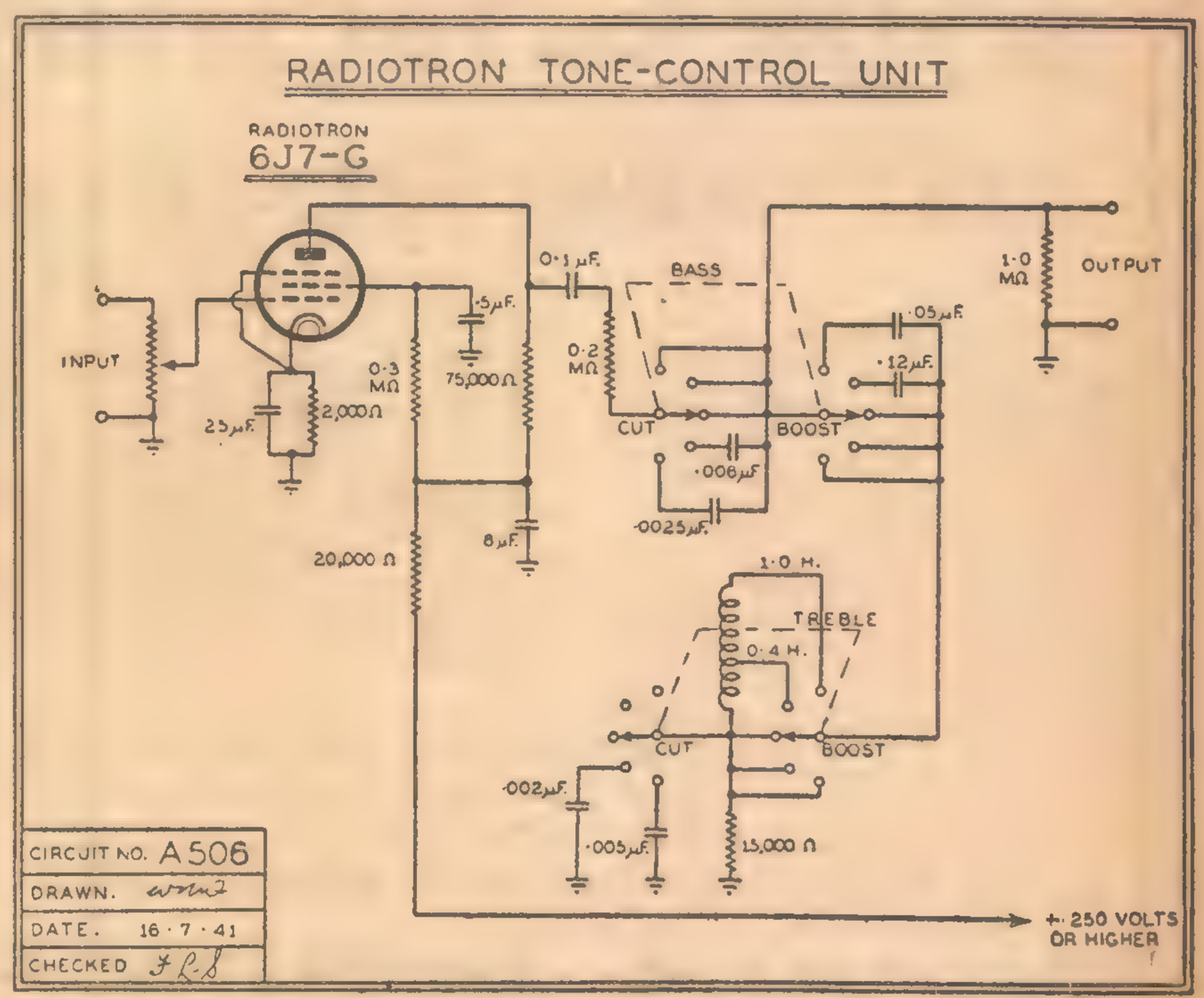


Figure 9. Here, once again, is the circuit of the Radiotron tone control unit, first published in "Radio and Hobbies" for September, 1941. Details of the special choke required are given herewith. The unit provides independent bass and treble accentuation and attenuation.

At middle frequencies, the input impedance of the network as it stands is near enough to 0.1 megohm, changing in rather complex fashion at the bass and treble end. It may be reduced by dividing the resistance values and multiplying the capacitance values by any desired factor. Multiplying the resistance values and dividing the capacitance values increased the impedance.

Although the impedance may be reduced to advantage for certain purposes, there would be a definite practical limit to increased impedance. Reduction in the capacitance of the .0001 mfd. condenser for treble boost may mean that the naturally increased significance of the associated valve and circuit capacitances would upset the operation of the circuit to a greater or lesser degree.

POSITION IN AMPLIFIER

Because the network introduces a loss of more than 20 to 1, it must not be used to feed the grid circuit of a valve in a position in the amplifier where it requires a high grid swing.

If, for example, an attempt were made to connect the network in the grid circuit of a power valve or even a phase splitter requiring, say, 15 volts grid swing, the previous stage would have to deliver 15 x 21 equals 315 volts peak—an impossible state of affairs. This is a further argument for our earlier suggestion of installing it in the plate circuit of a preliminary triode amplifier stage connected ahead of the existing amplifying equipment.

By way of comparison, and for those readers who have requested it, we are republishing the circuit of the Radiotron tone control unit, from the September, 1941, issue of "Radio and Hobbies."

The unit is more elaborate than the one under discussion, and provides bass and treble cut in addition to the bass and treble boost. Adjustment is by means of switches, instead of potentiometers, which have the advantage of giving continuously variable control.

GREATER BOOST

Maximum boost and cut is about 18 db. at the extremes of the normal audio band, and is therefore somewhat greater than available from the simpler unit. The odd capacitance values can be made up by paralleling smaller condensers, but the choke has to be specially wound. Details of the choke are as follow:—

It is wound on a wooden bobbin made from a ¾-in. length of ¾-in. diameter dowel to which is attached 2¾-in. diameter end cheeks made from three-ply wood. It should be wound preferably with 40 SWG gauge, SSE, or DSC wire; ordinary enamel wire can be used, provided care is taken to guard against shorted turns caused by kinks in the wire or faulty insulation. The coil may be jumble wound by hand.

For the 0.4 henry section, wind on 4520 turns. For the 1.0 henry section add an extra 2220 turns, to bring the total to 6740. If additional boost is desired, the maximum inductance may be increased to 1.4 henries, for which a total of 7570 turns will be required.

MR. L. B. GRAHAM
Principal of the A.R. College.

HOW DRY CELLS OPERATE

War has brought the dry cell into prominence in no uncertain fashion. The armed forces have come to light with orders for batteries to operate thousands of portable receivers and transmitters, field telephones, torches and a variety of other devices. Owing to the brownout conditions and shift work the demands of the civilian population have risen steeply. All of which explains why country listeners have had some difficulty in obtaining dry cells to operate radio receivers.

A DRY cell is a device whereby chemical energy may be converted into electrical energy. A point which many people fail to realise is that a dry cell does not store electrical energy. Instead it simply stores chemical energy which may be converted into electrical energy.

The modern dry cell as we see it today is actually a modification of the somewhat primitive Leclanche type cell. This type of cell, which was very popular for bell ringing and similar purposes, consisted of a glass jar which acted as a container, a piece of carbon surrounded by some closely-packed manganese dioxide, a sheet of zinc, and, finally, a saturated solution of sal-ammoniac.

The carbon rod formed the positive electrode, whilst the zinc formed the negative electrode, and the sal-ammoniac acted as the electrolyte. The manganese dioxide, although not essential, is most desirable if the cell is to give any reasonable length of life

POLARISATION

If a piece of wire, or electric globe, or some other form of "load" is connected between the zinc and the carbon, an electric current, at an initial pressure of 1.5 volts, flows from the carbon rod through the "load," and back to the zinc.

Due to chemical action inside the cell itself, hydrogen would be formed around the carbon rod, thus setting up a high internal resistance After a short period of operation, the internal resistance of the cell would build up to a sufficiently high value as to prevent the cell from operating at all. When this point is reached, the cell is said to be "polarised."

The prevention of this polarisation is essential for a long life, and it is for this reason that the use of the manganese dioxide is most desirable. This chemical has an abundance of oxygen and, when tightly packed around the carbon rod, the oxygen will combine with the hydrogen formed around the rod, thus producing water.

The amount of water formed is very small and is not sufficiently large materially to affect the cell's action. Since the manganese dioxide prevents the cell from becoming polarised, it is usually called the depolarising agent.

MODERN DRY CELL

Although its principle of operation is identical with that of the Leclanche type cell, our modern dry cell is entirely different in its mechanical construction. Perhaps one of the main disadvantages of the Leclanche cell was that it did not lend itself to portability, and, with the construction of our modern dry cell, this defect has been most efficiently overcome.

Figure 1 shows a diagram of a dry cell as it would appear if cut down from top to bottom through the carbon rod. The zinc, which acts as the negative electrode of the cell, is shaped into a container and does away with the necessity for any other container. On the base of the cell, inside the zinc cup, is an oiled cardboard washer.

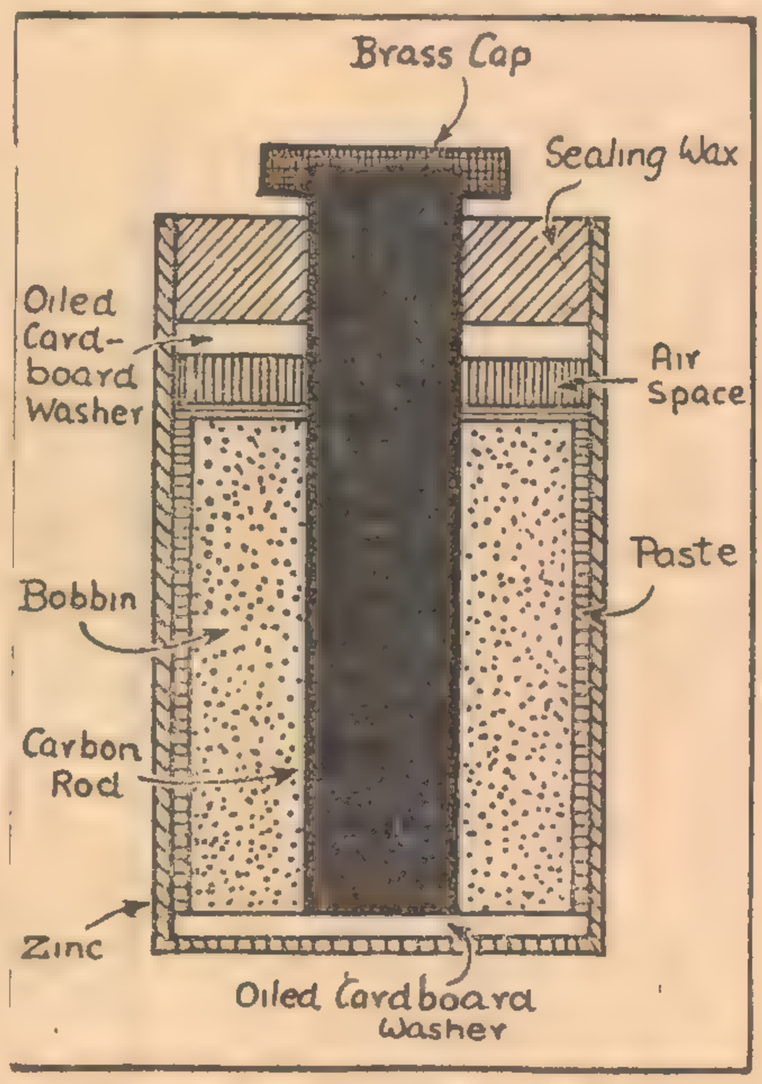


Figure 1. Cross section view of a conventional dry cell built up in a cylindrical zinc can. Such cells have been quite successful in the past but are wasteful of space when packed together in a single battery.

This washer serves the dual purpose of preventing the carbon rod from touching the zinc can, and it also prevents any chemical action taking place at the base of the cell. This latter point is most important, for any chemical action which may occur here would produce gases, and since these would have very little chance of escaping, they would possibly cause the cell to burst open.

CARBON AND BOBBIN

The next part to be placed inside the zinc cup during construction is the carbon rod, which is firmly embedded in the centre of a bobbin. This bobbin contains the depolarising agent, namely manganese dioxide, together with other chemicals, two of which are carbon and sal-ammoniac.

These two chemicals are used to ensure good electrical contact between the electrolyte and the carbon. The electrolyte, which is in the form of a paste, is poured into the cell between the bobbin and the zinc. The chief constituent of the electrolyte is the sal-ammoniac, whilst flour and mercuric chloride are also used.

The flour is used to give the electrolyte a "pasty" consistency, which when "cooked" assumes a jelly-like nature. For the "cooking" process, the cell is partly immersed in hot water (care being taken not to allow the water to enter the cell), at a temperature of about 70 degrees C., for about 10 minutes, the actual time being dependent upon the size of the cell, the larger cells taking more time.

COMMERCIAL ZINC

Chemically pure zinc, which would prove to be most expensive in the manufacture of dry cells, is really most desirable. Since, however, it would be most impracticable to use such, ordinary commercially pure zinc is used, with the addition of mercuric chloride to the paste.

This mercuric chloride combines with the zinc and forms a fine coating of mercury on the zinc surface. This allows the zinc to be eaten away uniformly throughout its whole surface area, and the ill-effects of any slight impurities in the zinc are thus counteracted.

Once again, referring to Fig. 1, we

see an air space between the top of the bobbin and the top cardboard washer. The purpose of this air space is to allow for the expansion of any gases formed in the cell during operation. Sealing wax is poured over the top of the cell to give it mechanical strength as well as preventing evaporation of the electrolyte and of any moisture inside the bobbin.

The brass cap which is tightly clamped onto the top of the carbon rod is to facilitate the making of any electrical connection such as soldering. The carbon rod is usually paraffined to prevent any ammonia, which is formed in the cell during its operation, from reaching and corroding the brass cap. The effectiveness of the sealing of a dry cell is very important.

SHELF LIFE

Once made, the duration for which a dry cell can be kept without being used, and without appreciably deteriorating, is termed the shelf life of the cell, and this shelf life is mainly dependent upon the evaporation of the moisture in the cell.

This point brings us to one of the main advantages of a dry cell, and that is, that there is very little local action, and, consequently, very little waste while the cell is not in use. Another advantage of the dry cell is that it requires no attention whatsoever for its maintenance. In this respect the lead-acid type of cell, which needs continual attention, offers a very strong contrast.

The shelf life of a small size dry cell as used in torches is approximately proportional to the square of the size of the cell. That is, if we have two different small cells, one being twice the size of the other, then the larger cell will have a shelf life of approximately two squared equals, four times the shelf life of the smaller cell. With the very large dry cells, such as those used in telephones, the shelf life is approximately directly proportional to the size of the cell.

LAYER-BUILT BATTERIES

The most recent development in the manufacture of dry cells is the layer-built type. Fig. 2 shows the construction of this type of cell, which, as can be clearly seen, is revolutionary as compared with our usual type of dry cell. As the name suggests, this cell is constructed in layers.

Firstly, we have a sheet of zinc, which forms the negative electrode of the cell A piece of cardboard, which is saturated with paste, is laid against this zinc. Then there is a fine piece of porous paper between the saturated paste board and the bobbin. The bobbin, which contains the manganese dioxide, is next, and, finally, the carbon, which is sprayed on the outside of the bobbin, forming the positive electrode.

On looking at the diagram of Fig. 2, it will be seen that there is a coating of carbon on the outside zinc surface. The purpose of this carbon on the outside is simply to enable good electrical contact between individual cells, if the cells are connected in series as in a battery.

A battery made from layer-built cells has no interconnecting wires between cells as in the case of ordinary types of batteries. Instead, the cells are simply placed one on top of the other, and pressed firmly together, being held in this position by a strapping of brown paper. Each cell delivers the usual 1.5 volts, and, like any other type of dry battery, requires 30 separate cells connected in series to give us our 45-volt "B" battery.

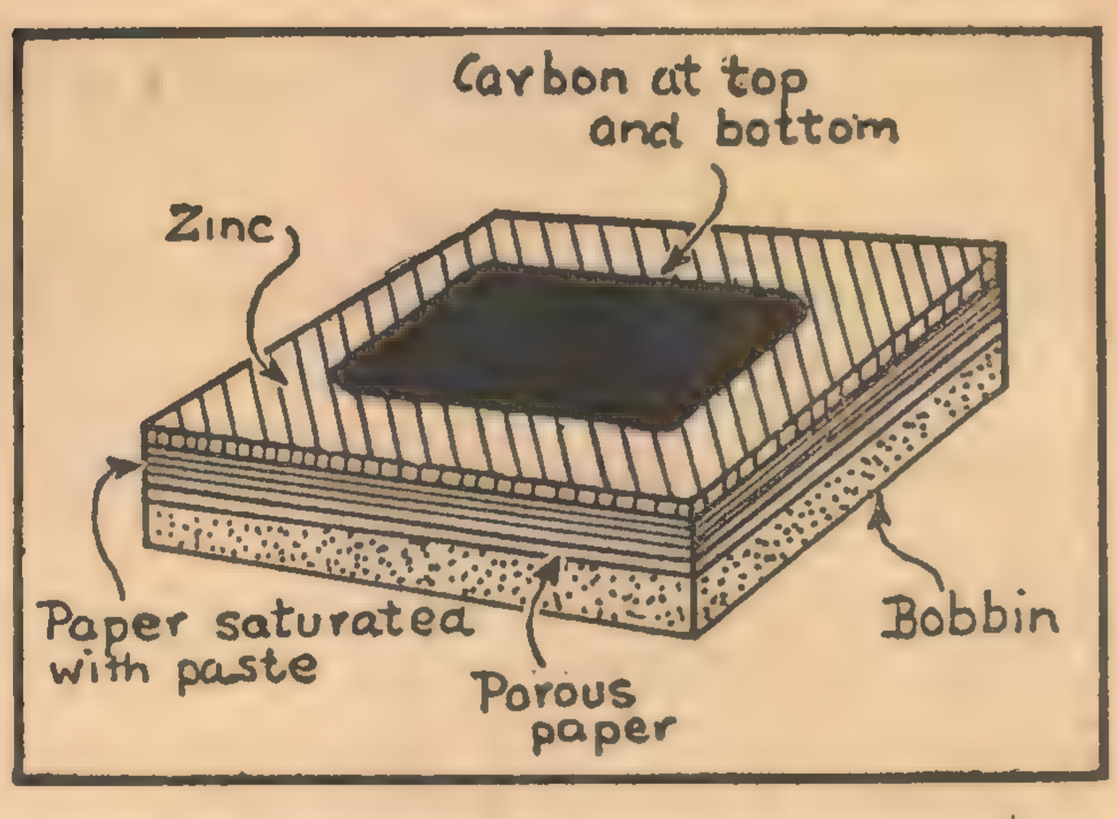


Figure 2. Diagram showing the essential details of a modern layer-built battery. The shape of the unit makes for compactness where a number have to be grouped together as a single battery. In addition, connecting wires are eliminated, adjacent cells making contact through the carbon coating.

OBVIOUS ADVANTAGES

The cells of a layer-built battery, being square and not of the usual circular shape, have no wasted spacing between cells, and also require very little insulation and connecting wires. For these reasons, a layer-built battery can be made with the same physical dimensions of our conventional dry battery, but being capable of delivering twice the output.

From the above description of the layer-built battery, it is obvious that it has advantages over the ordinary type, and no doubt you are wondering just why it is not on the market in Australia.

Unfortunately, the machinery used for its manufacture is entirely different from the machinery at present being used, and to change to this new construction would impose very heavy expense upon our manufacturers. Because of the present international situation, and also considering the comparatively small Australian consumption of dry batteries, they hardly feel that this extra expense is justifiable at the present time.

COST AND SIZE

The size of a dry cell has absolutely no effect on its voltage, this being 1.5 volts for all, from the smallest to the largest dry cell made. The size, however, does affect its life, and in this respect the life of a dry cell is somewhat in proportion to the square of the size.

Since the cost of a battery increases in direct proportion to its size, it is clear that by paying twice as much for a battery you receive approximately four times the life. For this reason it is false economy to buy small batteries where you habe sufficient room, as in a large console cabinet, to store the larger ones.

When used in portable radios, of course, it is not practicable to use large batteries, and this is one of the penalties we must pay for the small size.

Since the valves used in portable radios only require 1.4 volts for their filaments, and since the dry cell delivers 1.58 volts when new, it is essential that some form of dropping resistance be used in one of the leads of the "A" battery, and for this purpose 0.25 ohm is usually sufficient for a receiver consuming about .25 or .3 amps of filament current.

A dry cell should always be tested for voltage while under the drain to which it is being subjected in normal operation. If tested when not delivering any current, it may give as high a voltage as 1.4 volts and yet be absolutely worn out.

WORK OUT YOUR OWN MATHS PROBLEMS

In order more adequately to illustrate some point in the text, or to show the characteristics and capabilities of some unit, most technical radio publications find it necessary on occasions to publish graphs of one kind or another. In the minimum amount of space a graph is capable of giving information which would be virtually impossible to give in words.

HOWEVER, we have a feeling that many readers have long forgotten all they know about graphs and now pass them by instead of seeking out the information they have to give. Whether you ever had anything to do with graphs or not, there is no need to avoid them, for they are neither mysterious nor difficult to understand. This article is calculated to make readers more "graph conscious."

Graphs are used in all kinds of ways. Engineers use them for their own particular purposes; financiers and treasurers draw pretty red ones to show the rise and fall of monetary affairs; fond mothers, with a mathematical turn of mind, may plot baby's weight against his age, becoming very perturbed when the line shows a horizontal or downward trend.

WHAT IS A GRAPH?

For those who may never have studied graphs and are wondering what all this is about, we might state a graph (or, as it is sometimes called, a curve diagram) is simply a pictorial representation of the relationship between any two factors, when the value of one is dependent on the value of the other.

A graph may be drawn simply to record the details of the relationship, or it may be used to solve a problem not capable of solution by other simple mathematical means. Again, it may be used to present a general picture of affairs, in which case it is far more revealing and easy to grasp than a long list of figures and values.

First requirement to the drawing of a graph is a sheet of paper ruled off by a series of horizontal and vertical lines, spaced according to some predetermined scale. The horizontal line which we choose to form the bottom of the graph sheet is usually known as the base line, or "abscissa." Distances marked along the vertical scale are the "ordinates."

by C. E. Birchmeier

In drawing a graph, it does not really matter which values are placed on the abscissa or ordinates. However, the conventional method is to place the quantity, whose rate of change is being studied, along the vertical scale.

Now, in the construction of a graph, it is necessary to have a point of origin from which all distances are measured. If you look at Figure 1a you will see the general layout for all graphs, covering both positive and negative quantities.

You will notice a square has been divided off into four equal portions by horizontal and vertical lines. The centre of the square, or intersection of these horizontal and vertical lines, is conventionally considered as having zero value and is known as the point of origin, from which all distances or values are marked off.

Any point within the square can be located and plotted from this origin, by means of two numbers, one representing the distance along the horizontal abscissa, and the other the distance along the vertical ordinate. Note that, in the case of distances measured along the abscissa, those to the right of the point of origin are positive in value, whilst those to the left are negative. Likewise, those measured along the vertical ordinates are positive above the origin point, whilst those below are negative.

POSITIVE AND NEGATIVE

In each square you will see the direction of positive and negative values is marked in and shown by the arrows. If we had to draw a curve having only positive quantities then the top right-hand square would be used, whilst if they were all negative, then the bottom left-hand square would be used, and so on.

Actually, this business of subdividing a square is basic and elementary and serves merely to show how mathematicians have arrived at the conventional way of considering graphical values.

In actual practice, when one has come to grasp the idea the point of origin and so on, one does not have to draw and subdivide a square each time a graph is to be drawn. The procedure is simply to take a piece of ruled paper and, with due regard to the signs of the quantities involved, to choose a position or a corner as the point of origin, thereafter plotting in the various values as required.

In cases of necessity, graphs may sometimes be drawn with the values arranged in other than the conventional manner, but this is to be avoided, if possible, to avoid confusion.

LOCATING A POINT

Now let us see how it is possible to locate a point on a graph by means of two numbers, which we will assume to be within the numerical limits of the scale being used. Referring to Figure 1b, let us locate the position of a point A, knowing the plotting points to be 4 and 6, both numbers being positive.

Knowing the point of origin, we would count four divisions along the horizontal scale and then six divisions up the vertical scale, which will give the position of the point A. Simple enough, isn't it? It is always taken for granted that the first number refers to the abscissa and the second to the ordinate.

Obviously, before one can begin to draw a graph, it is necessary to choose a suitable scale, so that the values to

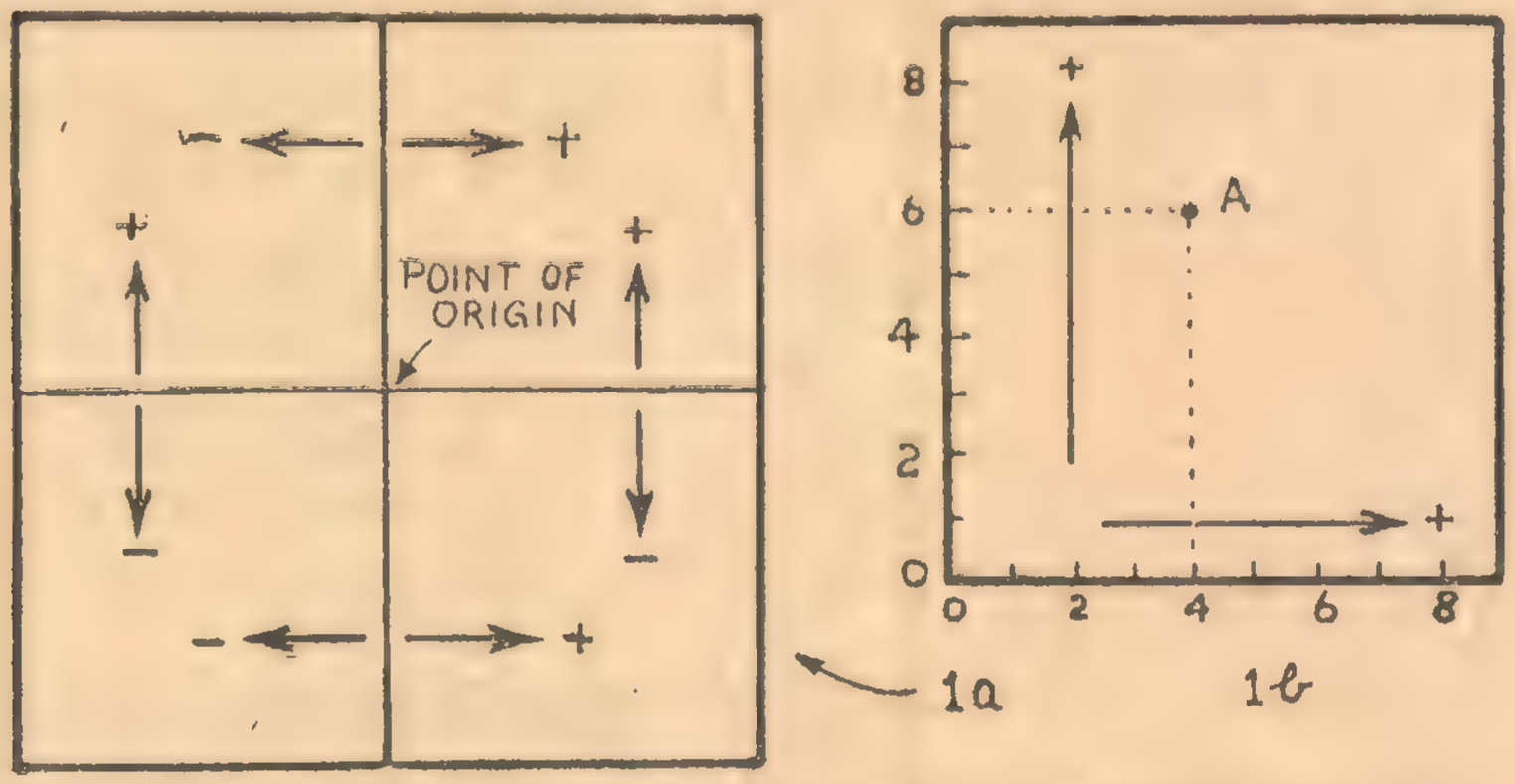


Figure 1a, on the left, shows the elementary conception of the point of origin and its relationship to the graphical correlation of values having either positive or negative signs. Figure 1b shows how a point A can be located once abscissa and ordinate values are known.

be related can be marked out along the edges of the graph. It may be necessary to rule up the paper to suit, or one may have on hand suitable ruled graph paper, which then only requires to be suitably marked out.

As an example, suppose we decide to draw up a graph showing the distance a man traversed every hour up to 6 hours, when walking at a rate of, say, 2 mph.

First of all, decide on the scale. Since the total time of walking is 6 hours at a speed of 2 miles per hour, it is obvious that he will cover 12 miles during the period, so, for a start, we need to represent this distance. A scale of ½-inch to the mile might be satisfactory. Likewise, for the time scale, we could use, say, ½-inch to represent ½-hour.

DETERMINING SCALE

There are no set rules for determining the scales. Actually, it is a matter of choosing values that will give a reasonably clear figure without being inconveniently large or small. Also, it is desirable to have the plotted line or curve lying at a general slope of about 45 degrees. If it rises too steeply or lies too flat, the graph is more difficult to read.

The cure is to choose another scale for the abscissa or ordinates which will have the desired effect on the slope of the plotted line. Of course, if the line is considerably curved, an undesirable slope at either end necessarily has to be tolerated.

Another point to note is that the outline of a finished graph has not necessarily to be a square. It may happen that the scales chosen will result in a rectangular figure.

Having then chosen suitable scales, they can be marked off along the vertical and horizontal lines. In the case in point, the distance representing the length of time the man walks, namely, 6 hours, can be marked off along the abscissa, while the distance representing the number of miles walked is marked off along the vertical ordinate. Each will occupy 6 inches.

PLOTTING THE POINTS

Now let us work out some intermediate values in order that a graph may be drawn to represent all that happens during the 6 hours' walk. Now, since he is walking at 2 mph, he will in—

1 hour cover 2 miles.
2 hours cover 4 miles.
3 hours cover 6 miles.
4 hours cover 8 miles.
5 hours cover 10 miles.
6 hours cover 12 miles.

From this information we can plot the required points on our graph.

The first position is obtained by moving the finger along the horizontal base line to a point representing 1 hour, and then vertically upwards until the line is encountered representing 2 miles; this gives the position of point A. Point B is similarly located from the values representing 2 hours and 4 miles. All other points are plotted similarly.

The next step is to join the plotted points together, as in figure 2, so as to obtain a continuous curve for the particular relationship.

When one factor is directly proportional to the other, the "curve" repre-

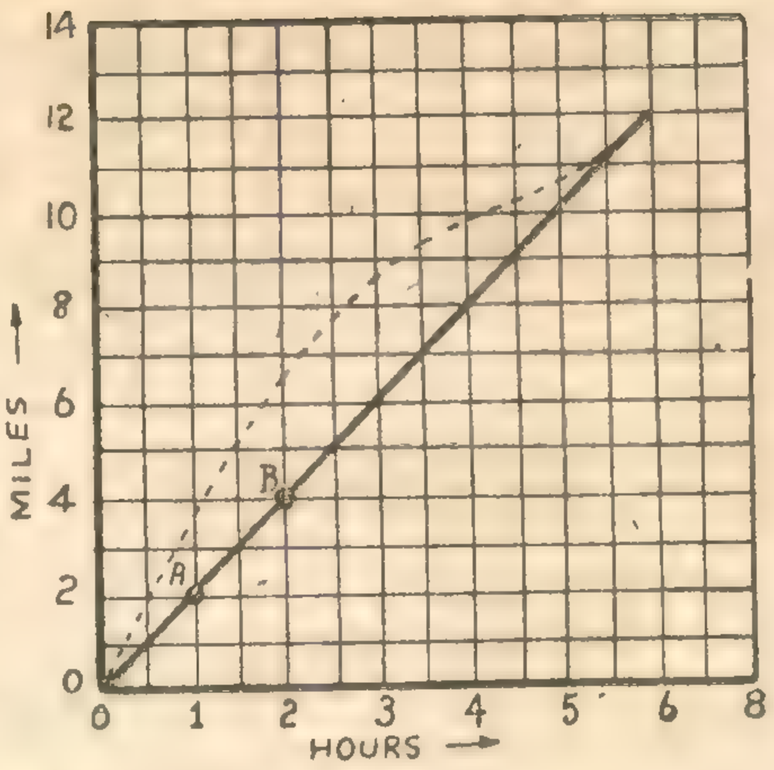


Figure 2. The graphical representation of the progress of a man who walked for 6 hours at the rate of 2 mph. Had the plot followed the dotted line, it would indicate that his rate of travel had varied considerably.

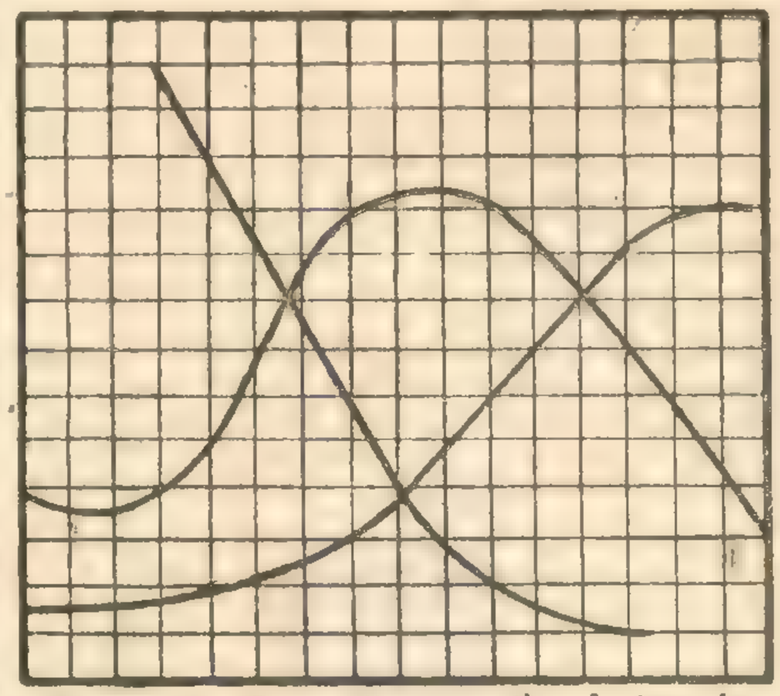


Figure 3. Depending on the factors involved, curves take on all manner of shapes and forms. Some follow a definite mathematical relationship, others are quite haphazard.

senting their relationship is actually a straight line, and, consequently, such a graph is commonly referred to as a straight-line curve.

If it is desired to read off the distance covered in, say, 3½ hours, this is simply done by locating the appropriate point on the time scale and moving vertically upwards from this point until the graph line is intercepted. The ordinate of the point of interception is 7, so that the answer is 7 miles.

If we wanted to know the distance covered in, say, 3¼ hours, it would be necessary to measure or pick by sight a distance half-way between the 3 and 3½ hour lines, for there is no actual scale division representing 3¼ hours. Similarly, the point of interception does not coincide with any line on the distance scale, and we would have to arrive by observation at the ordinate of the point of interception. In this case, we know quite well that it would be 6½ miles.

CARE NECESSARY

Even in plotting the points through which a graph line is to be drawn, it often happens that one has to locate points not falling exactly on any of the dividing rules. The location or reading off of such points is referred to as "interpolation." Obviously, interpolation has to be done very carefully if errors are to be avoided.

For a problem as simple as the one we have been discussing, we would not bother drawing a curve, or we could work out the necessary figures quite easily by other methods. However, it serves to illustrate the principles involved.

If the day happened to be hot and the man in question walked faster to begin with, gradually slowing down as he tired, the plot would take on a curved aspect. If we knew the distance he had covered at certain times, we could plot the curve and from it read off other intermediate distances, which could not be obtained by simple arithmetical methods. This is where the graph comes into its own.

ERRATIC CURVE

The man's walking speed may not decrease uniformly but he may put on a spurt here and there. In this case, an accurate plot of his progress would take on a wavy aspect, which would reveal at a glance his behavior at any point in the journey.

In the case of our pedestrian friend, the curve would not have any definite mathematical basis, being dependent on the heat of the day, the condition of his feet and the attractions by the roadside.

However, the plot of certain phenomena—say, the rate of decay in a damped oscillatory circuit, or the height above ground of a given point of a revolving

(Continued on Page 27)

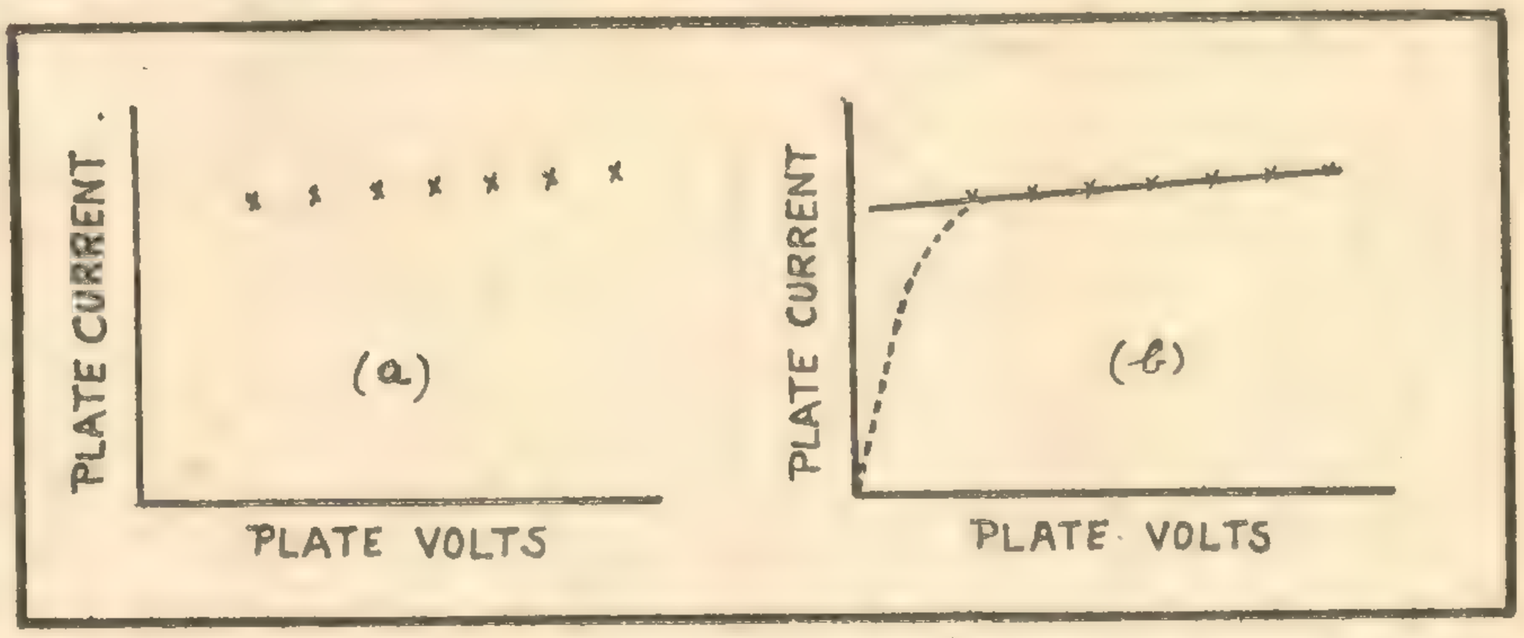


Figure 4. Illustrating the danger of exterpolation, or continuing the graph beyond the limits for which there are plotted points. The plotted points in (a) would seem to justify continuing the line as at (b), but there may be a sharp drop, as actually happens in the case of pentode plate current curves.

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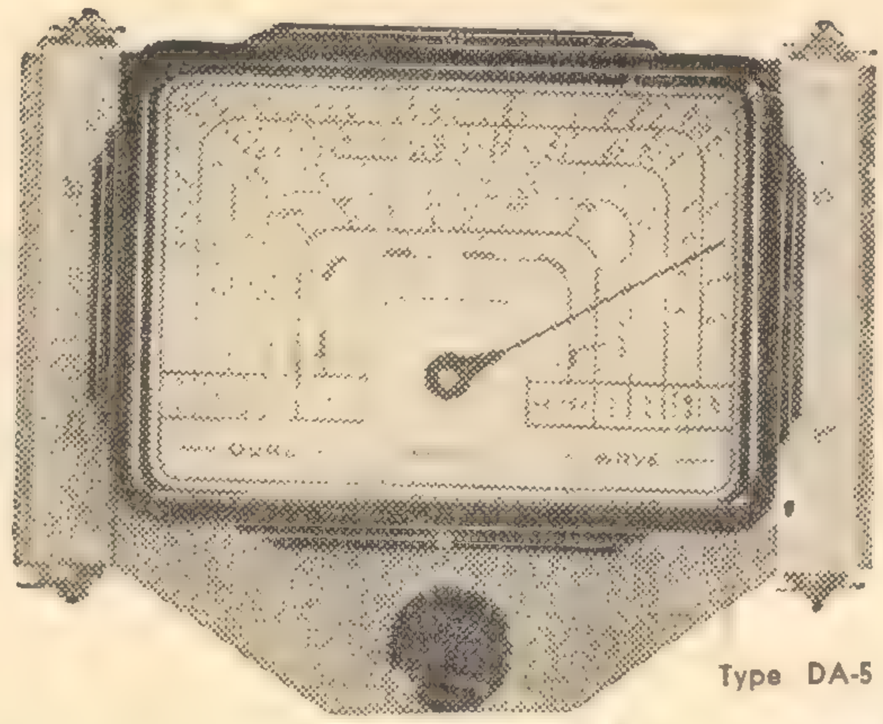

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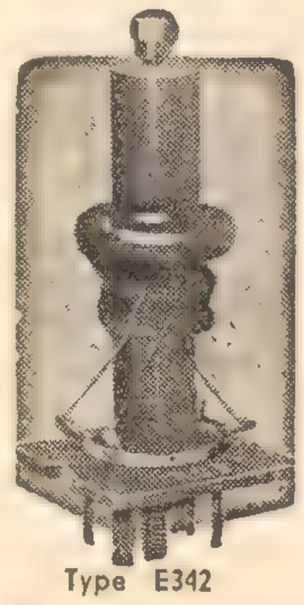
E344 Osc.	6/6	E347 Osc.	8/6

T.R.F. TYPE "H" GANG AIR CORE

T88 Aerial	6/6
T89 R.F.	6/6
T87 R.F. with reaction	6/6



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R.C.S. for Quality and Value

WORK OUT YOUR OWN MATHS PROBLEMS

(Continued from Page 39)

wheel—may have some definite and recognisable mathematical basis. Thus, we hear of sine curves and logarithmic curves and a variety of other like terms.

It is scarcely necessary at this stage to discuss these terms in any detail; it is sufficient to make passing mention.

Curves may take on all kinds of forms. Some may be a straight line, as we have already mentioned; some may be a single smooth curve; some may indicate recurrent phenomena; some may be quite haphazard; others may comprise a fairly long straight portion with a definite region of curvature at one or both ends.

Still another form of curve commonly met with is one having a long, fairly straight portion, followed by a definite "knee," and then another fairly straight portion.

EXTRAPOLATION

The shape of the line or plot is governed purely by the instantaneous relationship of the two factors being correlated. It does not in any way affect the method of reading.

Have a look at Figure 3, in which a few typical curve shapes are shown.

One point to be avoided in drawing graphs is the danger of extrapolation or the drawing in of lines to represent what you think should happen beyond the plotted points.

For instance, in Figure 4a, we have plotted a number of points representing the readings of plate current in a pentode for various plate voltages. As you will note, these lie in a delightfully regular line and anybody who knew nothing about pentodes might be tempted to arrive at the values he had not been given by continuing the line farther to the left, as shown in Figure 4b. But the result would be entirely incorrect for, in a pentode, there is a sharp knee in the curve, the plate current falling away rapidly, as shown by the dotted line.

So you see, one should be wary of taking liberties with curves. If you have to exterpolate, it is just as well to dot the curve to indicate the fact. Even between plotted points, peculiar things can happen, particularly if the points are a long way apart. The idea is, therefore, to obtain as many points as possible when plotting a curve to minimise the risk of overlooking sharp variations in the relationship of the two factors concerned.

LOGARITHMIC PAPER

There is quite an art to drawing nice even curves, but we can scarcely go into that here. Draughtsmen often use celluloid guides, commonly known as French Curves, to aid them in this.

For certain purposes, ordinary linear graph paper is not entirely suitable, for the plotted curve may be of poor shape or perhaps unduly cramped at one end. For this reason, curves are sometimes drawn on logarithmic (or log) paper. This simply means that the sheet is divided one way according to a linear scale and the other way according to a log scale. So called "log log" paper, has both scales divided up according to a logarithmic law.

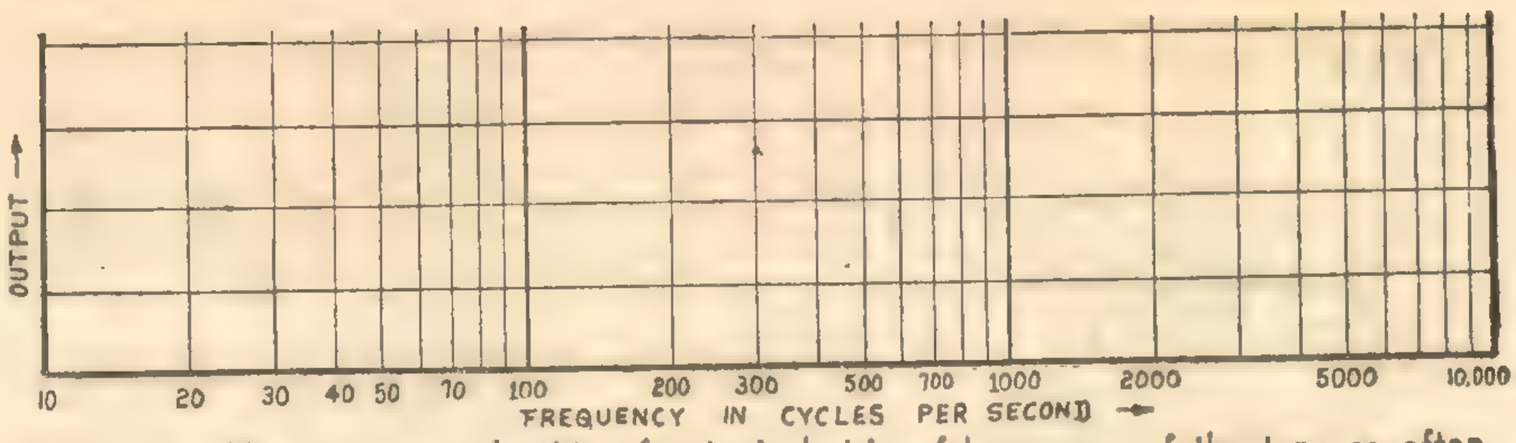

Figure 5. Here is a reproduction of a typical strip of log paper of the type so often used to show frequency response characteristics. The figures of frequency marked in show how the log scale is read. The vertical scale, in this case, is linear.

Most usual example in radio work is the use of log paper for frequency response curves. The use of log paper allows equal amount of space to be devoted to frequencies between 10 and 100, 100 and 1000, 1000 and 10,000 cycles per second.

GRAPHS AND RADIO

Figure 5 shows how the usual frequency scales are marked out on the bottom of a sheet of log paper.

Now that you have some idea of reading and constructing graphs, we will pass on to show how these are actually used and applied in radio work.

Here, graphs are not restricted to any one purpose, but may be used to illustrate such things as the variation in power output with load, voltage, and current relationships, loud-speaker frequency response, and so on.

After reading the foregoing notes, you should not have any great difficulty in extracting from any such curves the information they have to give. From the text or markings on the graph, take note of what the respective scales represent and then study the rise and fall of the curve and any outstanding trends or characteristics about it. Read off any actual figures you may be interested in.

Do not make the mistake of paying too much attention to the shape of the curve and too little to the units involved. For example, one can get a beautifully flat looking frequency response curve by using a lengthy frequency scale and a very cramped decibel or voltage scale. If redrawn with a more open decibel or voltage scale, the curve may show up as very peaked and bumpy indeed.

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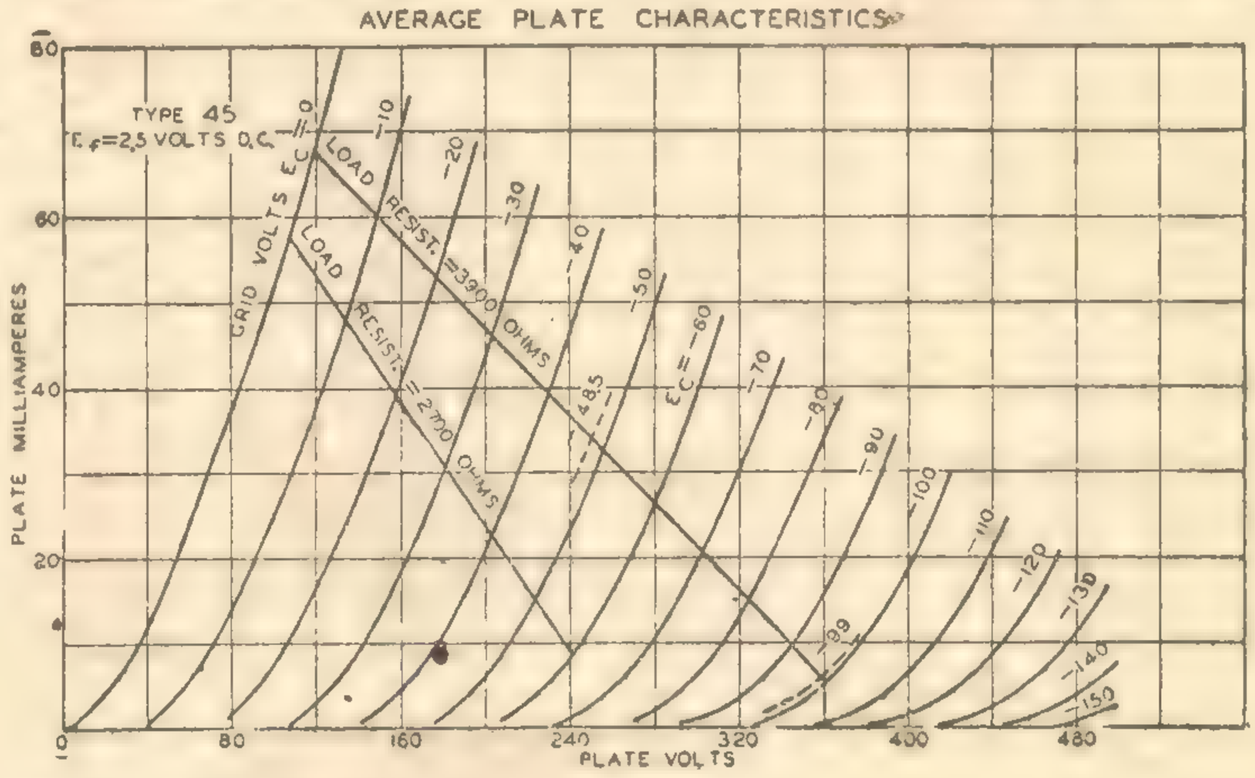


Fig. 6

Fig. 7

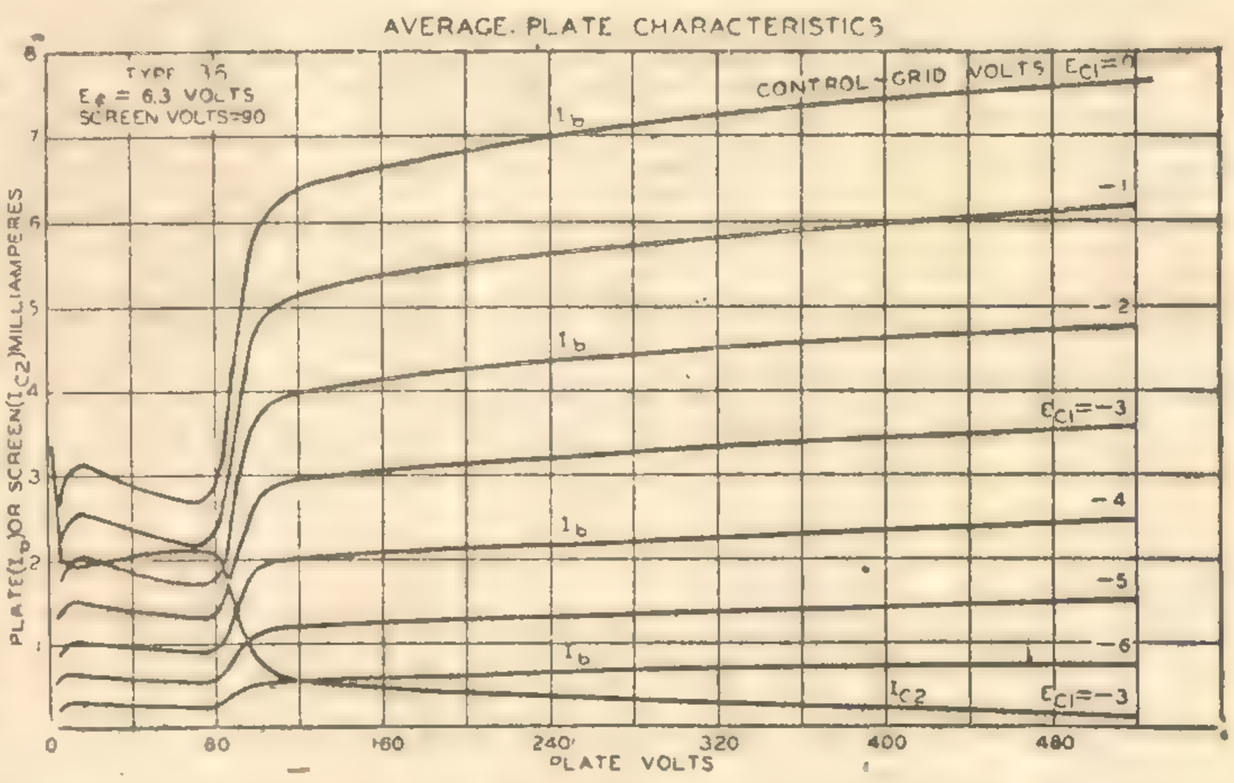


Figure 6 shows the plate family of curves for a type 45 power triode. Figure 7 shows the plate family for a type 36 tetrode. Note the pronounced kink in the curves of the 36, actually due to secondary emission. Both sets of curves are discussed at greater length in the text.

BATTERY OPERATED D/W RECEIVERS

SOME PROBLEMS OF DESIGN AND MAINTENACE

In this article, the technical editor answers some of the many questions put to us by country readers in regard to dual-wave battery receivers. Considerable space is devoted to the very real problem of unsatisfactory operation of the converter on the short-wave band. The article should be particularly helpful to servicemen who are continually coming up against this problem.

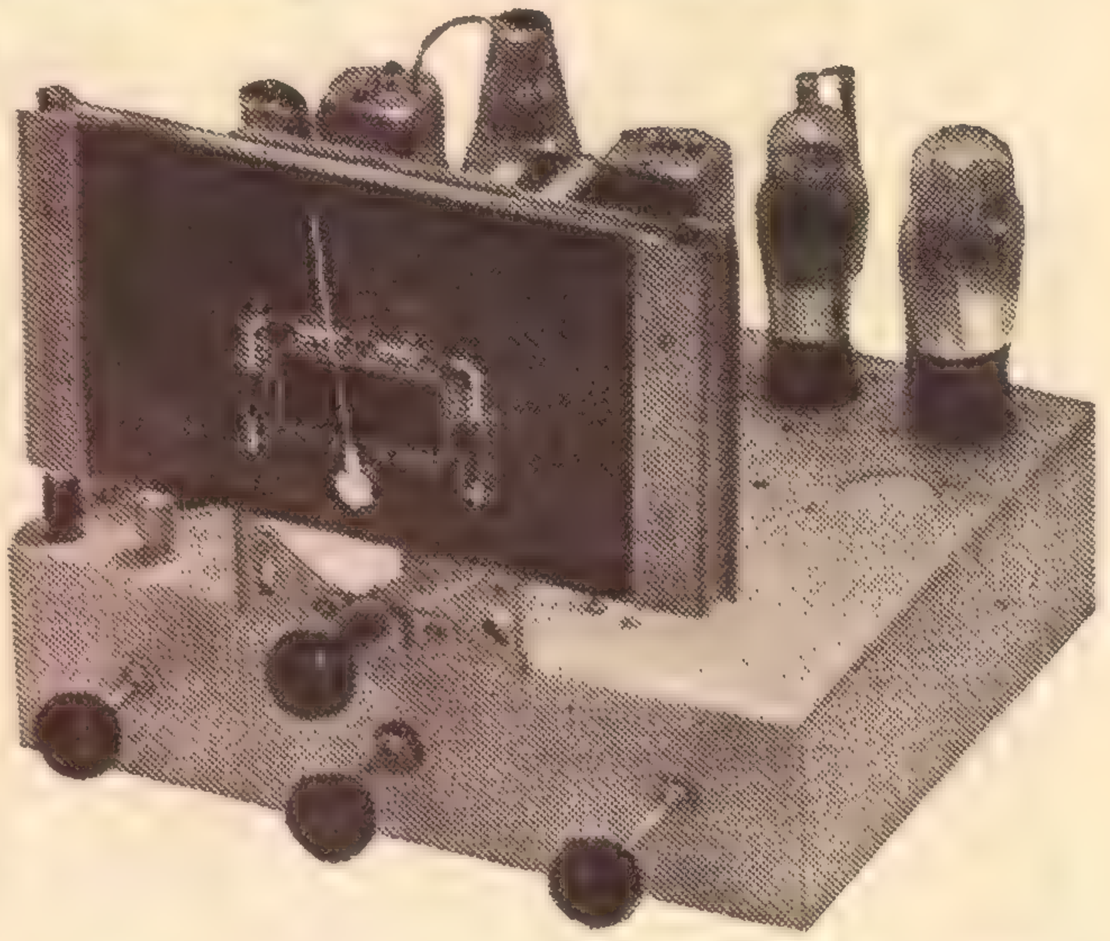


Figure 1. A front view of the experimental receiver mentioned frequently in this article. Much of the discussion is of a theoretical nature, but the circuit and information given about this set should be of assistance to readers who may desire to remodel an existing unsatisfactory receiver to an approved design.

IN order to investigate matters first hand, a dual-wave battery receiver was built up from typical standard parts.. The circuit of this experimental receiver and the discussion relating thereto should prove useful to readers who may desire to modify an existing receiver of unsatisfactory design.

Before actually getting into the technical matter, it may be helpful to some to make a few general comments on short-wave reception and receivers generally.

There was a time when short-wave listening was a rather haphazard pastime, requiring much concentration and a getting out of bed at unearthly hours. However, war and the events leading up to it have changed all that, and, for quite a large proportion of the time, a variety of really excellent signals are to be heard.

These signals, from both Allied and Axis countries, have their own particular interest, and, in addition, are often good enough to provide entertainment when the normal broadcast band is blocked by excessive static.

One reader mentioned in a recent letter that, at certain times of the year, more than one half his listening was done on the short-waves.

MORE CARE NECESSARY

To get the best from short-waves, a little more care is necessary than on the broadcast band. To begin with, the stations are not spread evenly around the dial, but are located in certain definite groups, in frequency bands which have been allotted for short-wave broadcasting by international agreement.

An additional point of note is that the stations do not occupy much space on the dial and careful tuning is necessary to avoid missing them altogether. For the guidance of short-wave listeners, a complete section is incorporated in "Radio and Hobbies" each month.

Now a few words about receivers. One can build small receivers, with one, two and three valves, to pick up broadcast and short-wave stations. However, because of their limited gain and selectivity, a certain amount of technical understanding is desirable on the part of the operator, if they are to be adjusted for best results.

Large receivers are more easily handled by non-skilled members of the family, and are therefore more suitable for general domestic use. For various reasons, supertererodyne receivers have displaced the ordinary TRF variety.

SUPERHET. RECEIVERS

Under existing Australian conditions, the smallest practicable superhet. receiver is one of four valves, comprising a converter, one I-F amplifier stage, a detector-audio amplifier and a pentode output valve.

A receiver along these lines, such as, say, the 1942 Pentagrid Four, described in "Radio and Hobbies" for March, 1942, is capable of giving excellent results in most localities, but lacks that impressive reserve of gain and selectivity which is so handy in difficult districts and for short-wave reception.

The addition of a stage of R-F amplification makes a tremendous difference to the performance generally, and is well worth the extra cost, if that can be borne.

by W. N. Williams

In fact, if we were to volunteer an opinion in the matter, we would probable say that a good five-valve, dual-wave receiver is the best all-round set for country listeners—we mean one having an R-F stage, a converter, a single I-F stage, a detector/audio amplifier and a single pentode output valve.

Still larger sets are all very well if one is keen on plenty of output and willing to bear the extra operating costs. However, it is usually a matter of noise, rather than station-logging ability, for, despite the number of valves which may be used, it is seldom that one strikes a receiver with a more powerful tuner than the type of five-valve receiver just mentioned.

VALVE FUNCTIONS

Some readers are apt to assess the station-logging ability of a receiver purely in terms of the total number of valves used, without due respect to their functions.

A case in point was the Pentagrid 46 receiver, described in "Radio and Hobbies" for April, 1941. This set could be operated as a six-valve job, but many readers apparently failed to appreciate the fact that the two extra valves were there to provide high audio power output when required.

As far as the tuner was concerned, it was simply the equivalent of an ordinary four-valve superhet., without an R-F stage.

(Continued on Next Page)

TOP VIEW OF EXPERIMENTAL RECEIVER

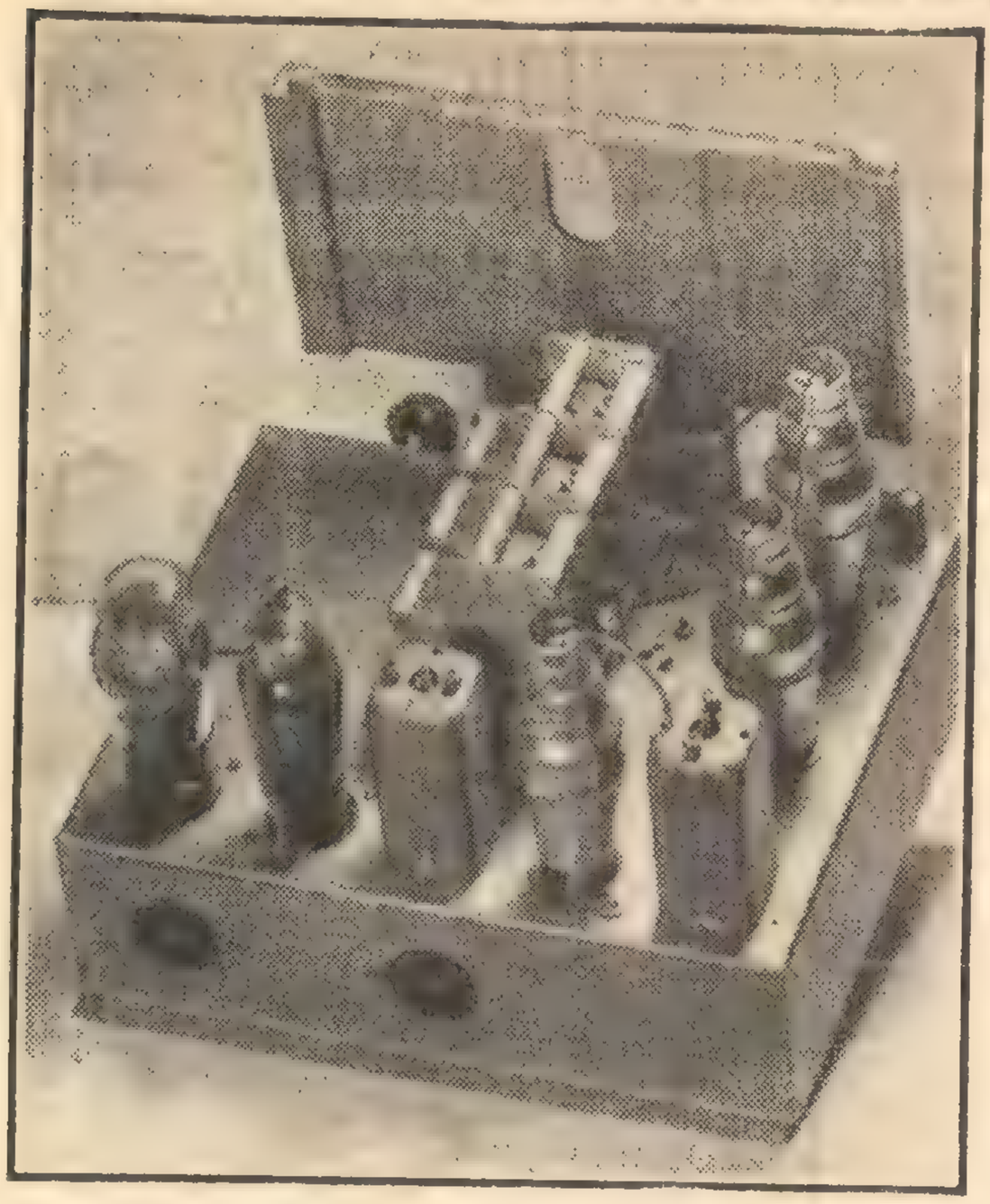


Figure 2. With a dual-wave receiver, particularly one with an R-F stage, layout depends largely on the type of coil unit chosen. The chassis layout adopted in the experimental receiver is about the best for the Crown PU-3 unit, which was used. Valve nearest the dial is the R-F amplifier; then comes the converter and, along the back, the I-F amplifier, detector & audio stage, and the output valve. Socket immediately below the output valve is for the speaker, that in the centre of the rear panel for the battery connections.

Having made these general remarks, we can now proceed to a more technical discussion of the problems of design and maintenance encountered with dual-wave battery sets.

Frequent reference will be made to the experimental receiver, but the first part of the discussion will be found to apply to battery receivers generally. It is proposed, for the most part, to confine remarks to the ordinary 2.0 volt series of battery valves, since these are the types most frequently used in dual-wave battery superhets.

Heart of any superhet. receiver is the converter valve, for upon it perhaps more than on any other single valve, depends the ultimate performance of the receiver.

For a-c sets, the designer has had a wide choice of types; these have had their own advantages and peculiarities, but, on the whole, they have at least been fairly reliable.

BATTERY CONVERTERS

The position with respect to converter valves for battery sets has never been anything like as happy. There have been fewer types to choose from, and their operation has generally been far more critical.

The reason for this is not hard to find, and is simply that the valve-designer has to work with one eye on the performance figures of the valve and the other on the total current it will draw from the battery supply. Of course, he also has to pay attention to the opinions of production engineers who have to mass-produce the valve.

First battery converter valve in Australia was the American type 15, intended for use as an autodyne and not used in dual-wave receivers. This was superseded by the 1A6, for which the modern octal-based equivalent is the 1D7-G.

The 1A6 and 1D7-G are satisfactory enough in broadcast receivers, but are quite hopeless for use in ordinary dual-wave sets. The more recent 1C6 and its octal based equivalent type 1C7-G are still not ideal, but they will work on short waves with a little coaxing.

TRANSCONDUCTANCE OF THE OSCILLATOR

Main difference between the 1A6 and 1D7-G on the one hand, and the 1C6 and 1C7-G on the other, is in respect to the transconductance of the oscillator section.

Under certain stated conditions, American data quotes the transconductance of the oscillator section of the 1A6 as 425 micromhos. Under the same conditions, the oscillator transconductance of the 1C6 and 1C7G is 1000 micromhos—an increase of more than two to one.

As might be expected, this is achieved at the cost of increased current drain.

The transconductance of the oscillator section of a converter valve largely governs the valve's ability to continue oscillating under adverse conditions, as, for example, when the batteries run low, or on the short-wave band, where other difficulties occur.

Certain other converter valves of British or European origin have appeared on the Australian market and may still be in use in limited numbers. For the most part, these are rather similar to the 1C7-G as far as performance is concerned, and many of the following remarks in regard to the latter type will be found to apply.

Possibly the greatest single difficulty in connection with battery-operated dual-wave receivers, is that of maintaining the operation of the converter valve on the short-wave band. As inferred in the previous remarks, the 1C6, 1C7-G and other similar European types can be made to work, provided some care is taken with the operating conditions.

GOVERNING FACTORS

Factors which determine the ability of a battery converter to operate satisfactorily at high frequencies are: (1) The condition of the valve itself, in particular with respect to the transconductance of the oscillator portion; (2) the design and efficiency of the associated coils, in particular the oscillator coil; (3) the details of the associated circuit. These three factors may well be considered in turn.

Generally speaking, the converter valve has to be in good condition to oscillate consistently over the whole of the short-wave band. This does not necessarily mean the valve has to be new, for there have been plenty of instances where new valves have apparently not been up to the standard of valves of earlier manufacture.

Unfortunately, there is no easy way of picking out good and poor converter valves, for the average valve-tester does not give an absolutely reliable indication of the transconductance of the oscillator portion, which is the vital thing in this connection.

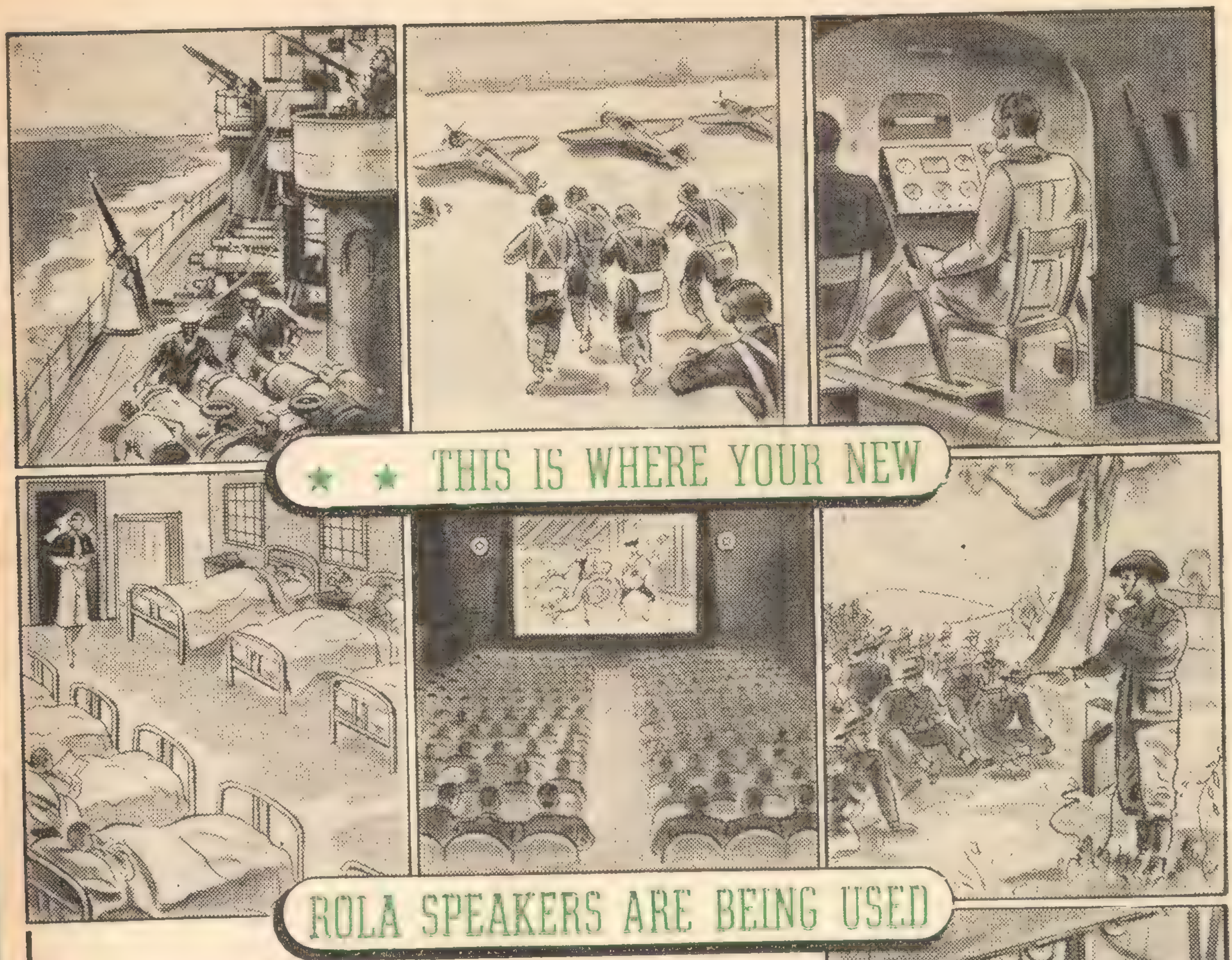
In any case, in view of the present acute shortage of valves, there is no opportunity to pick and choose; one is fortunate to get any valves at all. As far as the set-owner is concerned, it simply boils down to making use of the valve available, be it good, bad or indifferent. As far as new types are concerned, they can safely be forgotten until after the war.

ABOUT COIL KITS

Then there is the matter of coils. When, eight or nine years ago, there arose a demand for dual-wave receivers, quite a few different coil kits were put on the market for home constructors.

To put it mildly, many of these very early kits were "not so hot." Coils were often badly wound and of poor shape electrically. Formers were of any old material, and the switches, with their poor springs and copper surfaces, seldom gave more than a few weeks of trouble-free service. Add to this a few poor connections and sometimes a generous covering of dirt and flux, and

(Continued on Page 32)



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you have a pretty picture of inefficiency.

If your receiver is equipped with one of these very old coil units, and it is not functioning properly, it is doubtful whether it is worth while to expect anything much on the short waves. At any rate, before tinkering with the associated circuit, go over the unit as carefully as you can and clean up the switch contacts and the connections.

KITS MUCH IMPROVED

Fortunately, these very inefficient kits did not last long, and it wasn't long before coil manufacturers were given better switches, which, together with experience gained, allowed some quite good kits to be built up. Most of these covered the band from about 19 to 50 metres, or thereabouts.

Subsequently, there has been a trend to cover the higher frequency international broadcast bands, firstly the 16 metre band, and more recently the 13-metre band. While this might have been all very well for a-c converter valves, it made things still more difficult for the less efficient battery converters, with obvious results.

Originally, too, most manufacturers, if not all, made available separate kits for battery and a-c converter valves; the difference was mainly to do with the design of the oscillator coil. Unfortunately, people were continually found using the wrong kit. This, coupled with more recent manpower difficulties, has prompted more than one coil manufacturer to drop the two separate kits and to turn out a single kit to cover both purposes.

COMPROMISE DESIGN

The difference between a-c and battery converter valves is such that a compromise kit cannot very well give optimum results with both. Either the oscillator coil must be over-coupled for one or under-coupled for the other. Over-coupling may result in instability, and under-coupling in low grid current or even a complete failure to oscillate. Low grid current simply means very inefficient operation and low gain.

Thus it is that the extension of the coverage to the higher frequency bands, the possible deterioration in the average performance of available valves and the adoption of so-called universal coil kits have all conspired together to make the lot harder for the man who would build himself a dual-wave battery set.

Looking back over our issues of a couple of years ago, we are forced to the conclusion that it has been more difficult in recent times than it was then to build a dual-wave battery set with really good performance on the short-waves.

EXPERIMENTAL SET

However, such remarks are of little practical help to the enthusiast or serviceman who is faced with the problem of a set which is entirely or practically inoperative on the short-wave band. The valve manufacturers are not likely to turn out any revolutionary new type for the time being. The coil manufacturers are, generally speaking, anxious to help, but are very much tied up with war work. There remains the matter of the associated circuit.

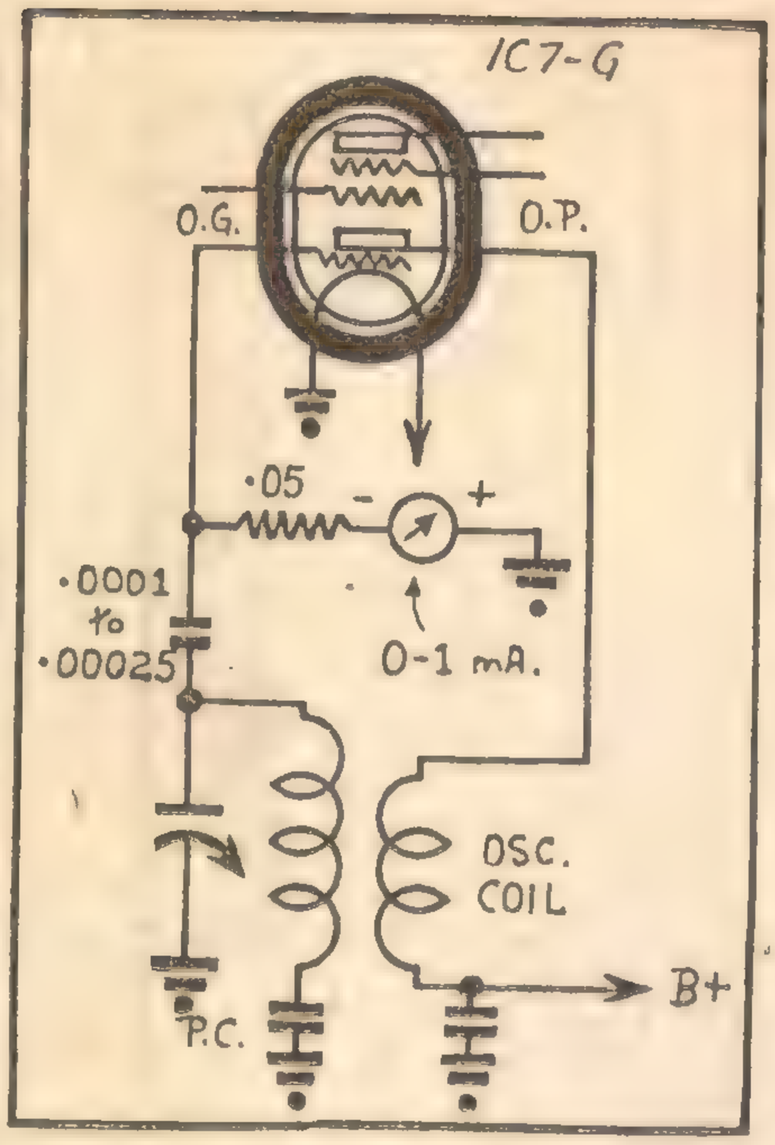

Figure 3. To measure the oscillator grid current, disconnect the oscillator grid resistor from earth and insert a 0-1 milliammeter as shown. The test indicates whether the valve is oscillating.

In order to approach the matter from a more practical viewpoint, we built up a receiver, using the standard parts which have been on the market for some considerable time. Actually, we used a type of H 3-gang, a standard "Crown" PU-3 dual-wave box and a 1C7-G converter. The circuit was designed carefully, but was conventional enough. Main features of the circuit are explained in brief towards the end of the article.

As we expected, the set proved to be extremely good on the normal broadcast band. After alignment, sensitivity was terrific, and selectivity of a very high order.

On the short-wave band, however, it was quite a different story, for there was little sign of the "punch" apparent on the broadcast band. The reason was not hard to find; whereas, on the broadcast band, the oscillator grid current was well up around the 150 microamp. (0.15mA.) mark, over most of the band, it fell away to 40 on the high frequency end of the short-wave band, 49 in the centre and a mere 9 at the extreme low-frequency end.

OSC. GRID CURRENT

Of course, the inevitable loss in stage gain of the R-F amplifier at high frequencies would not help matters, but it is rather hopeless to look for good performance with a grid current as low as this. No grid current curves have been published in recent times for the 1C7-G, but RCA quotes the optimum figure of grid current for this type at "slightly less than 0.2 milliamp"; this can probably be taken to mean between about 150 and 200 microamps.

This figure can be attained on the broadcast band, but may be higher than practicable on the short waves. Generally speaking, an oscillator grid current of about 100 microamps (0.1 mA.) is desirable on this band.

So then, when checking a poor receiver, irrespective of the type of coil kit used, first job is to measure the oscillator grid current. An ordinary 0-1 milliammeter is suitable for the purpose, and should be connected into circuit, as shown in the accompanying diagram.

Although one may be unable to do much about the coils or valves, observation of sets and examination of circuits shows that various minor changes can be effected which may have a marked effect on the performance of the receiver.

First of these is more mechanical than electrical, and has to do with the wiring, &c.

CIRCUIT AND LAYOUT

Begin by examining the oscillator circuit. See that the leads between the pins of the valve socket and the coil or coil box are as short and direct as possible. Often, a distinct improvement in wiring can be effected by swinging the socket around to bring the pins closer to the coil assembly.

If the oscillator plate and grid leads are taken to terminals on a coil box, trace them through in the box and see that the joints are good. We hesitate to suggest possible shortening the leads in the box, since this might have some secondary effect on the tracking.

Check the wipers on the switch and see that they are making a good firm contact. Examine the whole assembly and see that flux has nowhere been

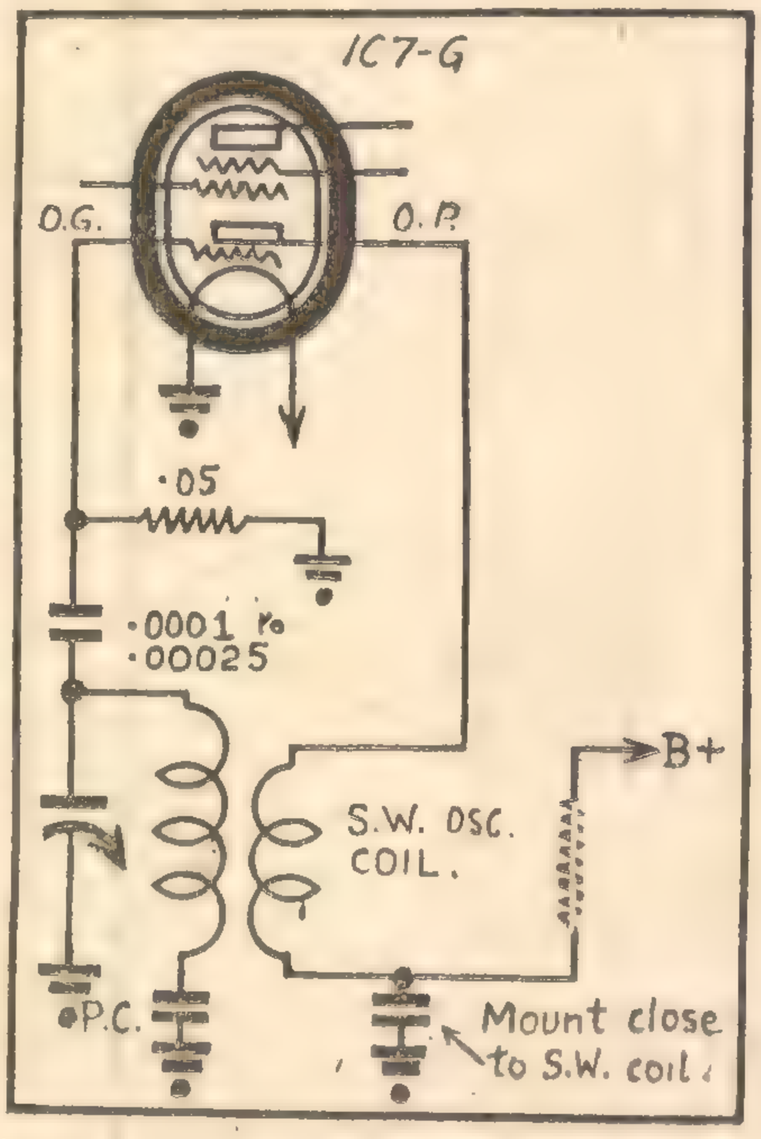

Figure 4. Short leads are essential for efficient operation. In particular, see that the oscillator anode bypass condenser is located as close as possible to the coil.

boiled into the bakelite insulation. If there is any flux or dirt to be seen, carefully wipe it away with a piece of rag around the end of a match.

Turn the chassis over and see that the wiping contacts on the gang rotors are actually earthed to the framework of the box, or to earth points provided for the purpose. It is quite unsatisfactory to rely on the more or less accidental contact made through the mounting bolts. The outside braiding of a piece of shielded wire is ideal for earthing gang rotor contacts to the chassis or coil box.

OSCILLATOR BYPASS

Final point to check is the position of the bypass condenser on the oscillator B-plus line. Whether the oscillator anode is fed direct from B-plus or through a resistive network, the cold end of the oscillator coil should be bypassed to the frame of the box as close as possible to the short-wave oscillator coil.

It may not hurt to instal the condenser in question actually within the box. Some coil boxes have this condenser and the various AVC condensers actually built in.

Next point to watch is in regard to the operating voltages; consider first the filament voltage.

For the 1C7-G, the filament voltage should be a full 2.0 volts for proper operation. A freshly-charged accumulator will supply this voltage on load without difficulty, but a run-down cell will not do so. Therefore, see that the A battery is not neglected. Low filament voltage will affect the broadcast band to a certain extent, but it will have a more serious effect on the short-wave band.

A further point in this regard is to see that there is no undue voltage drop in the filament circuit. The total filament drain in a typical five-valve set is usually around the ¾-amp. mark, and only a very small amount of resistance is necessary to cause quite a severe drop in voltage.

CHECK LEADS, SWITCH

It is a good idea to equip the A battery leads with a stout pair of dog clips, unless the battery is provided with proper terminals and the leads with spade lugs. Even then, they should be kept quite clean of the corrosion caused by the acid fumes.

Hasty, twisted connections are a menace to good short-wave performance, for a voltage drop of anything up to a quarter of a volt can easily occur in practice.

Certain types of switches are also liable to cause trouble in this respect. In some grease-filled toggle switches, we have actually measured a voltage drop of 0.2 amp. This, together with a certain amount of additional drop in the leads, is quite sufficient to put a set out of commission on the short-wave band. It's just a small point, but it is well worth checking up on.

The matter of high tension and bias voltages opens a large field of discussion. First, the matter of bias voltage.

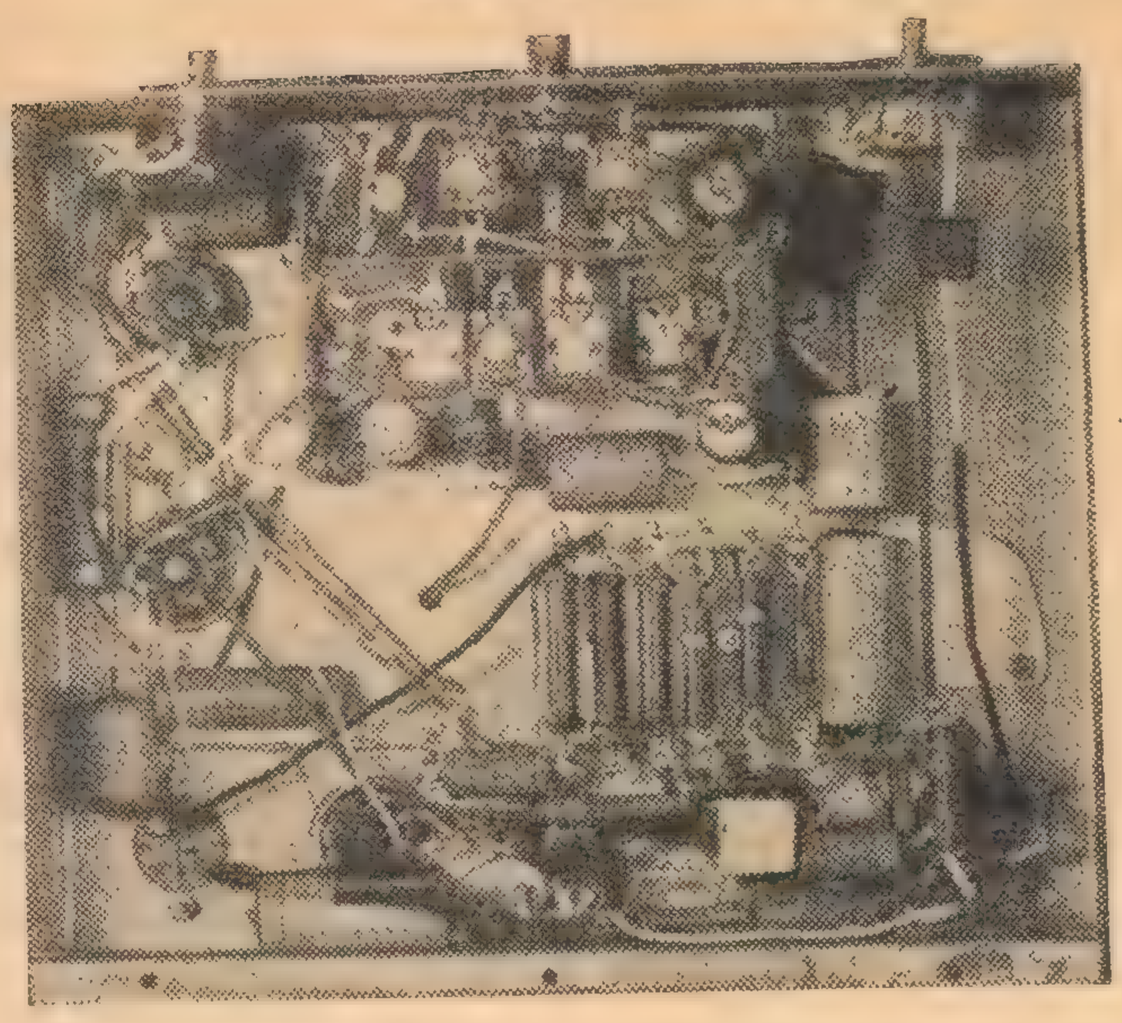

Figure 5. Without making the picture unduly large, it is difficult to obtain much useful detail from the underneath view of a chassis such as this one. However, sufficient detail is evident to show the main features of the under-chassis layout. Leads that matter are short and not bunched together. Resistors comprising the back-bias network are mounted on a panel for the sake of rigidity.

SIGNAL GRID BIAS

When the 120 milliamp Australian series was introduced, with the zero bias 1C4 and 1M5-G, many designers chose to operate the 1C7-C also with zero bias, often reducing the screen voltage to about 45 volts, in order to limit the high tension current drain. One or two "Radio and Hobbies" receivers used the 1C7-G under these conditions.

It was subsequently discovered that, although zero-bias operation of the 1C7-G was generally satisfactory on the broadcast band, some damping effect occurred on short-waves, which was sufficient to prevent the oscillator functioning at highest efficiency on the short-wave band.

The same effect may possibly be apparent with some Continental converter valves, but about this point we are not clear.

In the receiver which we built up, we tried operating with the 1C7-G on both zero and -3.0 volts bias, and found the latter to be far more satisfactory.

Therefore, when up against a receiver which stubbornly refuses to oscillate on the short-wave band, it is as well to check over the circuit to make sure that there is provision for a minimum bias of -3.0 volts on the 1C7-G. If this is not the case, a suitable rearrangement of the circuit will be almost sure to effect a marked improvement. This point is a most important one and can stand to be stressed.

Note that it may be necessary to modify the screen circuit of the 1C7-G somewhat in order to provide the full 67.5 volts under the higher bias conditions.

In a receiver which has been designed for zero bias operation of the first two or three valves, there may be some difficulty in arranging for the necessary minimum bias, without upsetting things generally. This would be particularly true if the coil box had a common return for the broadcast and short-wave R-F coils.

REARRANGING WIRING

Removal of the converter grid from the AVC line and connection to a source of fixed bias may possibly result in overloading on very strong signals, although this is not altogether likely in ordinary areas. On the other hand, it may be considered inconvenient to arrange a minimum bias on the AVC line.

One way out of the difficulty is to trace out and separate the returns of the broadcast and short-wave R-F coils, returning the former to the AVC line and the latter to the fixed bias source. This course was adopted in our experimental receiver, as you will see by reference to the circuit.

In the Crown PU-3 coil unit, the secondary of the short-wave R-F coil is returned direct to earth, being actually soldered to the frame of the coil box. This connection has to be unsoldered and the lead taken to a nearby vacant terminal lug, thence to be connected to the fixed bias source. The .05 mfd. bypass condenser is then connected between the terminal lug and the frame of the box.

HIGH TENSION VOLTAGE

Some of our less-experienced readers may find these last few paragraphs rather hard to follow, but it is difficult to be more explicit without taking up more space than is available. Putting it into a single sentence, it simply means that, if you want to get the best out of a 1C6 or 1C7-G on the short-waves, it is essential to see that it has a minimum grid bias of -3.0 volts.

Then there is the matter of the high tension supply voltage. Assuming the usual B supply voltage of 135 volts, it is conventional for broadcast band operation, to supply the oscillator anode from B-plus 135 volts through a 20,000 ohm resistor, bypassed where is connects to the oscillator coil. Thus, the

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SCHEMATIC CIRCUIT DIAGRAM of the EXPERIMENTAL RECEIVER

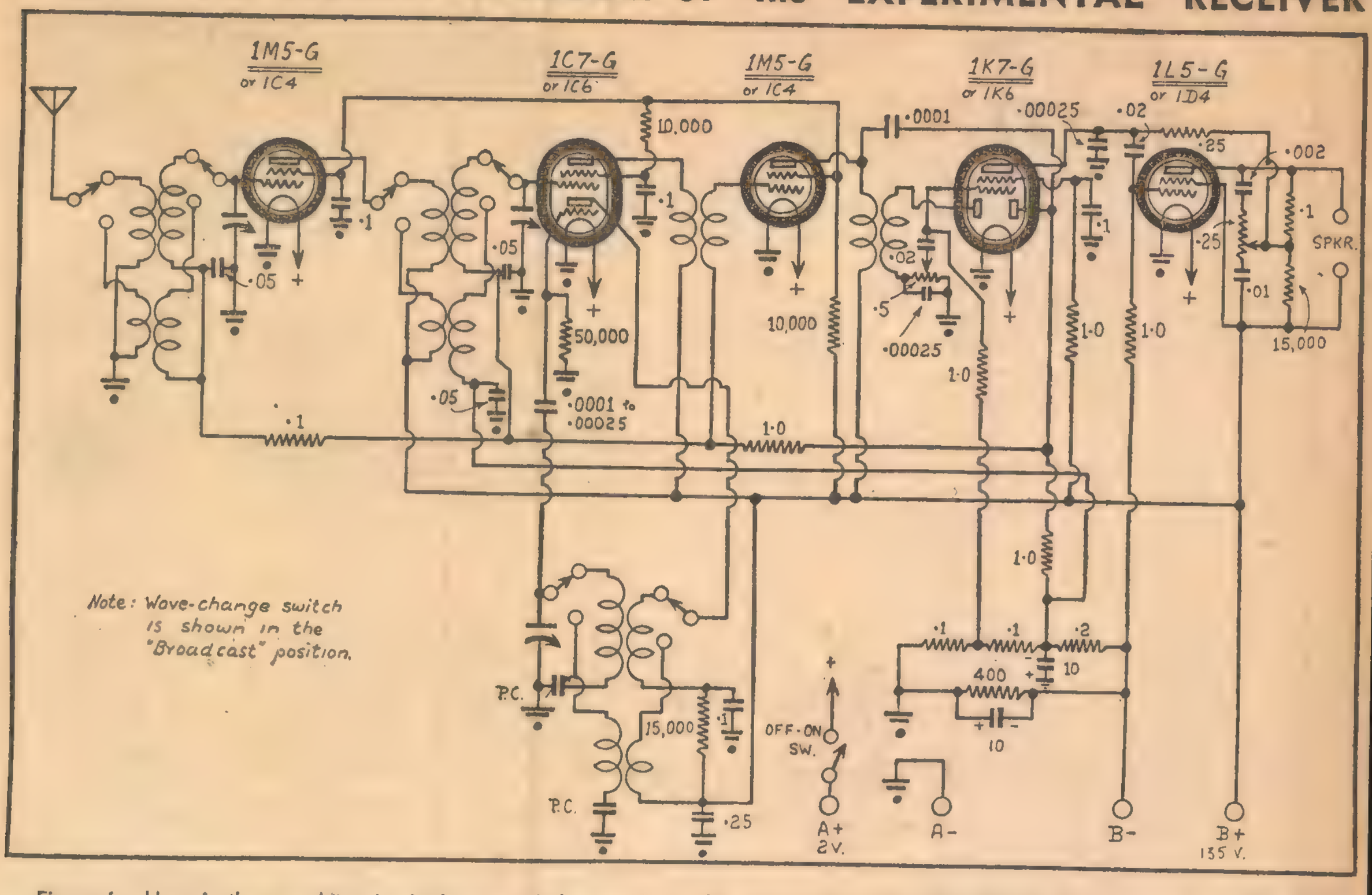

Figure 6. Here is the complete circuit diagram of the experimental receiver. Note that the B/C R-F coil returns to the A.V.C. circuit, the S/W R-F coil to a fixed bias source. Note also the separate B-plus feeds to the B/C and S/W oscillator coils. In some coil units these connections are not brought out separately and the leads have to be separated or the desired operating voltage obtained by switching, as explained in the text.

voltage actually applied to the oscillator anode is considerably less than the high-tension voltage.

MORE VOLTS FOR S/W

This arrangement makes for economy of operation and still allows the converter valve to operate efficiently.

In most cases the 1C7-G will not operate very well on short-waves with the reduced oscillator anode voltage, and it is desirable to reduce the value of the dropping resistor or even to eliminate it altogether.

If it is possible to identify and separate the B-plus connections to the broadcast and short-wave oscillator coils, the former can be coupled to B-plus through the conventional voltage dropping network and the latter can be connected direct to the B-plus line. When the receiver is switched from one band to the other, the correct oscillator anode voltage will then automatically be applied.

Some coil units may have these oscillator coil connections brought out to separate terminals, so that this is quite easy to arrange. Other units—among them the Crown PU-3 unit—have a spare bank on the switch intended for dial-light switching. If not required for this, the spare bank may be wired up so as to short out the dropping resistor for short-wave reception. In the PU-3 unit, the spare section is wired to three spare terminals on the side of the box.

This switching is not shown in the circuit diagram, the coils being shown separately fed.

It appears to be more or less futile to expect the 1C7-G to operate satisfactorily with ordinary coils, with a B supply voltage of only 90 volts or, indeed, with a run-down 135-volt bank.

Servicemen faced with a fractious dual-wave receiver are well advised to check up on the oscillator anode voltage on short waves.

COMPLETE LIST OF PARTS USED

1 chassis, 9 x 11 x 3½.
1 Crown PU-3 D/W coil unit.
2 I-F transformers (iron-cored).
1 three-gang tuning condenser.
1 dial to suit.
2 10mfd electrolytic condensers.
1 .25mfd tubular condenser.
4 .1mfd tubular condensers.
3 .05mfd tubular condensers.
2 .02mfd tubular condensers.
1 .01mfd mica condenser.
1 .002mfd mica condenser.
2 .00025mfd mica condensers.
2 .0001mfd mica condensers.
5 1meg resistors.
1 .25meg resistor.
1 .2meg resistor.
4 .1meg resistors.
1 .05meg resistor.
2 15,000ohm resistors.
2 10,000ohm resistors.
1 400ohm resistor, WW.
1 .5meg potentiometer.
1 .25meg potentiometer.
Sockets: 1 4-pin, 1 5-pin, 5 octal.
Valves: 2 1M5-G, 1 1C7-G, 1 1K7-G, 1 1L5-G.
Batteries: 3 45-volt Superdyne "B" batteries, 1 2-volt "A" battery.
Sundries: 4 knobs, 2 terminals, 4 small grid clips, 3 valve shields, hook-up wire, braided wire, 1 terminal strip, solder lugs, nuts and bolts.

PADDER FEEDBACK

When the oscillator anode is fed from B-plus through a series dropping resistor, the junction of the resistor and the oscillator coil must be bypassed with a condenser, usually of 0.1 mfd. If, instead of returning one side of the condenser to earth as is usual, the condenser is returned to the "hot" side of the padder, a certain amount of feedback occurs, which is in addition to the mutual feedback between the primary and secondary winding of the oscillator coil.

The particular circuit arrangement is referred to as "padder feedback" and has been mentioned quite frequently in

(Continued on Page 36)

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"Radio and Hobbies." It is often used, particularly in 1.4 volt receivers, to "pep up" the oscillator a little on the low frequency end of the broadcast band.

In order for the circuit to be effective, there must be a resistance in series with the oscillator anode feed, so as to prevent the 0.1 mfd. bypass condenser shunting directly the padder.

Experiment showed that the improvement in grid current obtained by leaving a series resistor in circuit and using padder feedback was no greater than that which resulted from feeding the oscillator anode directly from B-plus 135 volts.

An arrangement which permits padder feedback to be utilised on the short-wave band, at the same time retaining the full 135 volts on the oscillator anode, is shown in the accompanying circuit. An R-F choke, which naturally has low d-c resistance, serves to isolate the oscillator anode feed from the main B-plus line.

WORTHWHILE INCREASE

This circuit may or may not be easy to incorporate in a dual-wave receiver, depending on the construction of the box. In our experimental receiver, incorporation of the circuit gave a 40 per cent. increase in grid current as compared to the straight-forward circuit. Padder feedback has not been shown on the main circuit diagram, but servicemen and advanced enthusiasts should not have any trouble in making the necessary alterations.

In addition to the foregoing major considerations, there are two minor circuit kinks which are sometimes helpful in maintaining oscillation over the short-wave band.

First of these is to use a .00025 mfd. oscillator grid condenser in place of the more usual .0001 mfd. condenser. The higher value is suggested in certain American valve data books for the 1C7-G, and a brief test in the experimental receiver indicated an improvement in grid current of about 25 per cent. at the extreme low frequency end of the S/W band.

In some receivers, the change may cause instability on the broadcast band, for which a possible cure would be to increase the value of the oscillator anode feed resistor, or to load the secondary of the oscillator coil with a resistor of, say, 0.1 meg. or higher. However, instability will probably not be encountered.

POSITIVE GRID RETURN

The second small circuit kink worth trying, is to return the 50,000 ohm oscillator grid resistor to A-plus, instead of the usual return to A-minus. The change will inevitably cause an increase in oscillator grid current due to the small positive potential which will be applied to the oscillator grid. This current will flow, irrespective of whether the valve is oscillating or not.

Whether the change will really make any difference to the performance of the oscillator is open to query. However, it is a very simple thing to try out, and if it seems to assist the converter on the low frequency end of the S/W band, so much the better. If there is no sign of improvement, return the resistor to earth again.

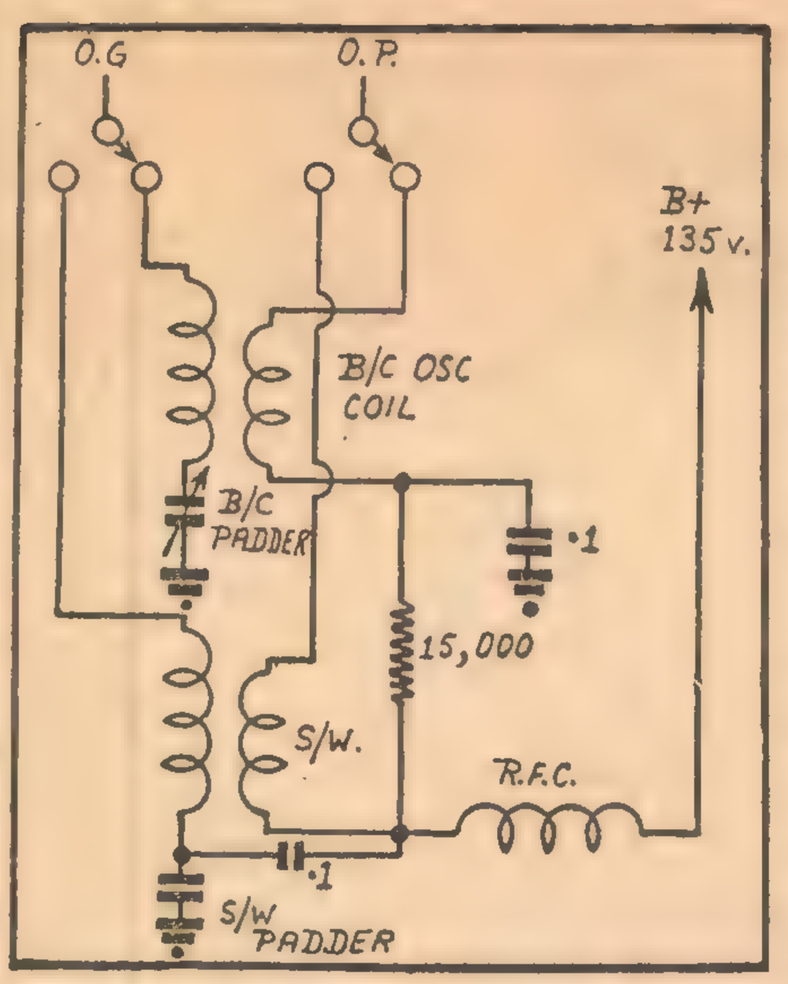


Figure 7. Wiring the oscillator coils in this manner permits the use of padder feedback on the S/W band, while retaining the full 135 volts on the oscillator anode. The modification will help matters considerably at the low frequency end of the band.

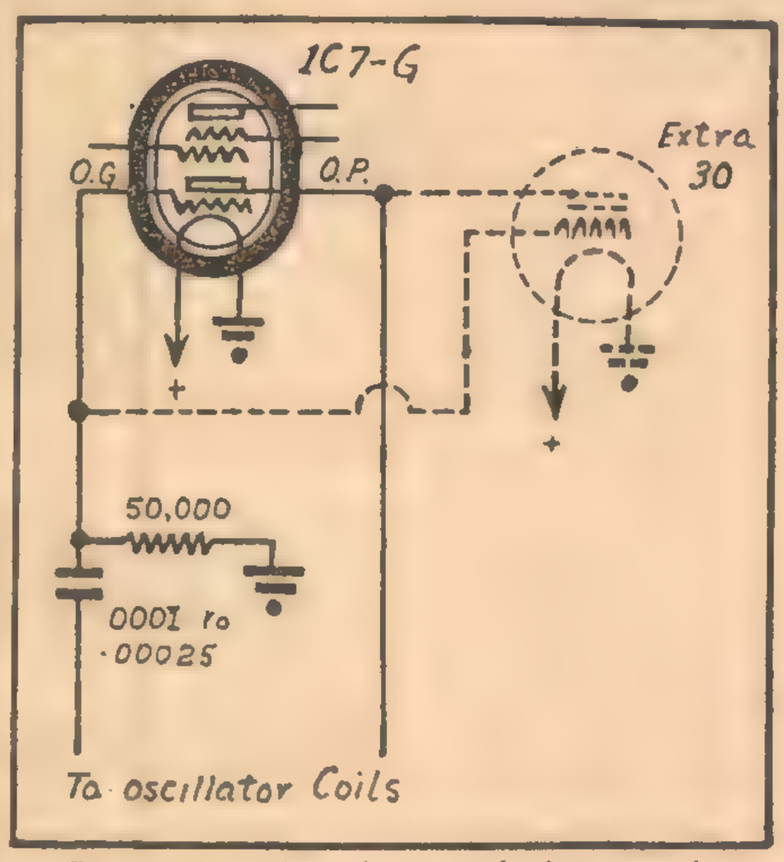


Figure 8. A scheme which is rather clumsy, but which nevertheless works in no uncertain fashion, is to connect an extra 30 in parallel with the triode portion of the converter. The extra capacitances necessarily have to be tolerated.

To summarise the foregoing discussion: If a dual-wave battery receiver is unsatisfactory on the short-wave band, measure the oscillator grid current. If there is no grid current, or if the figure is unduly low, especially at the low frequency end of the band, the following measures can be tried:

(1) Try another valve, if one happens to be available.

(2) Check to coil unit for faulty connections, or bad contacts in the switch, and check the earthing of the tuning gang.

(3) Make sure that the valve socket is clean and see that the layout and wiring makes for the shortest possible leads.

(4) See that the oscillator anode bypass condenser is in the most effective position.

(5) Make sure that the valve has a full 2.0 volts on the filament.

(6) Check the operating conditions. Minimum bias should be -3.0 volts, screen voltage preferably 67.5 volts, and oscillator anode voltage 135 or thereabouts. Bias voltage at least would have to be assessed from examination of the circuit rather than by actual measurement.

(7) If possible, try the padder feedback scheme.

(8) Try increasing the value of the grid condenser to .00025 mfd.

(9) Try returning the oscillator grid resistor to A-plus.

Singly, these various measures may not make any marked difference, but the aggregate of several small improvements effected by these means may be quite gratifying.

In our experimental receiver, after trying each of these various schemes, we were still not satisfied with the performance on the short-waves and a different oscillator coil, more suited to the 1C7-G, appeared to be the only solution.

NEW OSCILLATOR COIL

Mr. Cranch, of the Crown Company, accordingly made up for us an experimental oscillator coil to wire into the PU-3 coil unit. The new coil had a couple of extra turns on the feedback winding interwound in the grid winding.

When installed, the new coil gave a much better figure of grid current and made for more satisfactory operation all round. When wired exactly as shown in the circuit, with no padder feedback and a .0001 mfd. grid condenser, the grid current was 91 microamps on the high frequency end, 63 in the centre, falling away to just over 20 at the extreme low frequency end of the band.

Although rather low, this latter figure represents an improvement of more than two-to-one. The addition of padder feedback and a larger grid condenser would have improved matters still further.

The extra turns on the feedback winding appeared to increase the distributed capacitance somewhat, but this was offset by unscrewing the oscillator trimmer to its full extent and also unscrewing the iron plug a little more than usual.

The oscillator lead to the gang was also re-routed, so that it did not travel any distance parallel to the chassis. Had it been necessary, the oscillator trimmer could have been disconnected altogether, still further to reduce the capacitance across the circuit.

NEW COIL AVAILABLE

We understand from the Crown Company that duplicates of this replacement oscillator coil will be made available on application. Servicemen and enthusiasts who come up against a troublesome receiver with a Crown PU-3 coil box should therefore be able, if necessary, to procure this replacement coil. It should be stressed that the coil is intended as a replacement for this particular coil

kit, and covers the 13-40 metre band. Type number of the coil is IC 64-B.

Readers will obviously infer from the foregoing remarks that, if other methods fail, a set may be often pepped up on the short-wave band by adding a turn or so to the feedback winding.

This may be perfectly true, and may be all right for experienced people, but we are loath to suggest it as general practice. Coil manufacturers are justly very touchy about people tampering with their units, particularly when it comes to tampering with the coils themselves. So it is as well to remember that, if you do decide to try and rewind the oscillator feedback winding, you do so entirely at your own risk.

PARALLEL OSCILLATOR

Finally, before leaving the subject of battery converters, we will make mention of one scheme which has been used to obtain the desired results. The particular scheme is to wire an extra triode valve such as a 30, directly in parallel with the oscillator portion of the 1C7-G or 1C6..

The plate of the extra valve is connected directly to the oscillator anode of the converter valve; the grid is connected directly to the oscillator grid, and the filament is wired to the main filament circuit.

The addition of an extra triode in this manner causes the oscillator circuit to work very vigorously, in fact so vigorously that the oscillator anode voltage has usually to be reduced on the broadcast band to keep the receiver stable. Such measures may even be necessary on the short-wave band to prevent instability at the high frequency end.

EFFECT OF CAPACITANCE

Current drain of the extra valve is about a milliamp under average conditions, so that this is no great consideration.

Main difficulty with the scheme is that the added capacitance of the valve and associated wiring is almost sure to cut off some of the high frequency end of the short-wave band, and will certainly require the oscillator trimmer on the broadcast band to be unscrewed right out or disconnected entirely.

For this reason, it is essential to see that the extra valve is wired into circuit in such a way that there is absolutely no more additional circuit capitance introduced than can possibly be helped.

Certainly, this scheme is a compromise and is rather clumsy, but it may mean the difference in some cases between some S/W reception or no reception at all. A quick try-out in the experimental receiver, with the original standard oscillator coil, gave figures of grid current over most of the band of better than 150 microamps, and 85 microamps at the low frequency end.

So much, then, for converter valves and their unfortunate failings.

THE CIRCUIT

Lack of space does not permit the remainder of the amplifier to be discussed at length. However, the main points will be covered briefly.

RESISTOR COLOR CODE

VALUE	BODY	END	DOT
1 meg.	Brown	Black	Green
.25 meg.	Red	Green	Yellow
.2 meg.	Red	Black	Yellow
.1 meg.	Brown	Black	Yellow
.05 meg.	Green	Black	Orange
.015 meg.	Brown	Green	Orange
.01 meg.	Brown	Black	Orange

The desirability of having an efficient R-F stage ahead of the converter has already been pointed out. Obvious choice for this position is the 1M5-G. Another 1M5-G serves in the position of I-F amplifier.

The receiver incorporates a single stage of I-F amplification. However, with modern iron-cored I-F transformers, the gain and selectivity provided by this single stage is quite high and probably not far short of that provided by two I-F stages of a few years ago, using less efficient valves and I-F transformers.

Anyone thinking to duplicate this circuit should make a point of using high gain iron-cored I-F transformers.

The choice of actual operating conditions for the two 1M5-G valves was the subject of much debate. For reasons already stressed, the 1C7-G necessarily has to have a negative bias of —3.0 volts on the short-wave band. In order to avoid frequency shift, the bias preferably should be fixed. On the broadcast band, AVC is desirable on the converter grid to avoid the imposition of excessive control voltages on the R-F and I-F amplifiers, with powerful signals.

In view of the fact that a source of bias had in any case to be provided, and in view of the difficulty of providing anything more than a single

(Continued on Next Page)

THE UNDERNEATH WIRING DIAGRAM

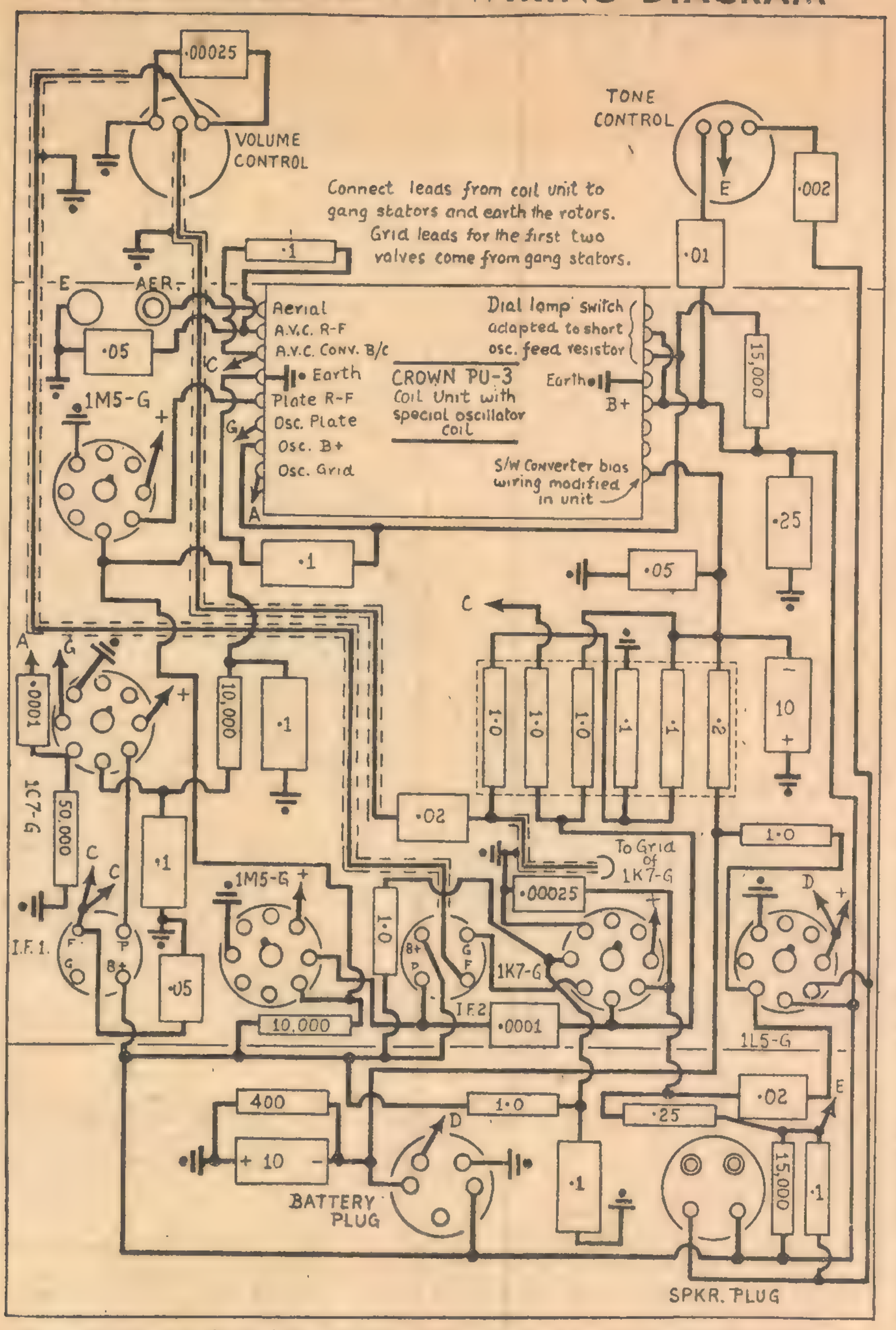


Figure 9. Here is the underneath wiring diagram drawn for the Crown PU-3 coil unit. For other coil units, the layout and wiring would be quite different. Note that the terminal lugs normally used for dial light switching have been wired to short out the oscillator anode feed resistor on the short-wave band. The grid return of the S/W R-F coil has been isolated and brought out to a vacant lug at the lower right hand corner of the box.

fixed screen voltage for the converter, it was decided to operate all three valves with a minimum initial bias of —3.0 volts. This called for a screen voltage of 90 volts for the 1M5-G valves, as compared to the usual 67.5 volts for zero bias operation.

It so happened that the figures of screen voltage and current worked out beautifully. A single 10,000 ohm 1-watt resistor serves to drop the voltage to 90 for the 1M5-G's and a further 10,000 ohm resistor drops it to 67.5 volts for the 1C7-G. The screen current of the 1C7-G serves to stabilise matters and the screen voltage remains almost constant under various reception conditions.

Operation of the 1M5-G valves under these conditions makes for economy in high tension current drain, although with some loss in gain.

Apart from the bias arrangements, the 1K7-G circuit is quite conventional and scarcely needs further comment. In wiring the socket, make sure that you get the diodes around the right way. Pin 4 is the AVC diode, pin 5 the detector.

The 1K7-G feeds into a 1L5-G output valve. This valve is over-biased for the sake of economy, but the output is not seriously affected. With a modern and efficient loudspeaker there is plenty of power for all practical purposes, and the tonal quality is excellent, thanks largely to the negative feedback.

TONE CONTROL

The tone control system is now sufficiently well known as not to require much comment. Rotated one way, it gives treble boost in the other, treble cut; in between, there is a position of balance where the frequency response characteristic is sensibly level. When wiring the control, connect it so that rotation in a clock-wise direction attenuates the treble; wired the other way round, the control is not smooth, owing to the taper of the resistance element.

Negative grid bias for all stages is provided from a back-bias source, thus simplifying battery requirements. A further advantage is that the bias voltages automatically decrease as the B batteries run down, thus allowing the valves to operate to better advantage under these disadvantageous conditions.

Approximately six volts is developed across the 400 ohm back-bias resistor. By means of a parallel connected high-resistance divider network, this voltage is broken down to —3.0 for the first three valves and —1.5 for the 1K7-G.

BATTERY DRAIN

Two 10 mfd. electrolytic condensers are shown in the circuit; those are included as a precaution against possible trouble with motor-boating. In some receivers, one or both may possibly be dispensed with without unduly affecting the operation of the set.

The receiver requires a 2.0 volt A battery, the A battery drain being 0.72 amps. Three 45 volt B batteries are also required to make up the 135 volts high tension supply.

On the short-wave band, with no signal input, high tension current drain was measured at 15.6 milliamps —not a high figure for this type of receiver. On the broadcast band, with no signal, it was 15.2 milliamps; with a typical input signal, current drain was just over 13.5 milliamps.

In all there are four connections to be made to the batteries, and a battery plug and socket can conveniently be used for the purpose. The filament "off-on" switch shown in the circuit was not incorporated in the experimental receiver, but could be installed in a convenient position on the side of the cabinet. It merely has to break one lead to the A battery.

OTHER COIL UNITS

The schematic circuit will remain unchanged, irrespective of the coil kit used, which is fortunate, for we can forsee that under the present circumstances enthusiasts will use the circuit with all shapes and varieties of coil units.

Only likely variation will be with regard to the oscillator anode B-plus supply, which requires to be changed for B/C and S/W bands. This will be quite simple with some kits; others will require slight modification to the wir-

(Continued on Page 52)

TONE CONTROL FOR THE 13W. AMPLIFIER

In "Radio and Hobbies" for March, 1941, we published the circuit of a 13-watt amplifier, using what was then quite a novel circuit arrangement. Right from the outset the amplifier was a startling success. However, we have had many inquiries from readers desirous of fitting a tone control, and the following notes may therefore be appreciated.

FOR the enthusiast who wants a really versatile tone control system, the best idea is to leave the amplifier proper as it is and to build up a special tone control stage to go ahead of it.

TONE CONTROL STAGES

Such a stage, eminently suitable for the purpose, is the "Radiotron" tone control unit, the circuit of which is republished elsewhere in this issue. The "Luxury Amplifier," described in "Radio and Hobbies" for November, 1941, was actually a combination of the original 13-watt amplifier and this particular unit. The power supply used admittedly was of more elaborate design, but this was an alternative and quite optional arrangement.

On the other hand, the simpler tone control stage described elsewhere in this issue could be used. It provides an independent and continuously variable degree of bass and treble boost. As a matter of fact, we were prompted to republish the circuit by a reader operating an amplifier along the lines of the "Luxury" job in a country theatre. He stated that the tone control unit was very effective, but had the disadvantage that the switching was rather abrupt; a further point was that, in practice, it was scarcely ever necessary to attenuate either end of the range.

"TOP-CUT" CONTROL

The fitting of an ordinary "top-cut" tone control is not a very difficult matter, and only requires the addition of one or two small components. The treble response may be reduced by introducing a suitable condenser in shunt with the plate circuit of the pentode voltage amplifier.

If desired, a range of condensers may be wired to a selector switch so that rotation of the switch introduces different condensers between plate and earth. The largest condenser would have to be about .005 mfd., or slightly higher, and the others could be chosen by trial and error to give the variation which happens to please you.

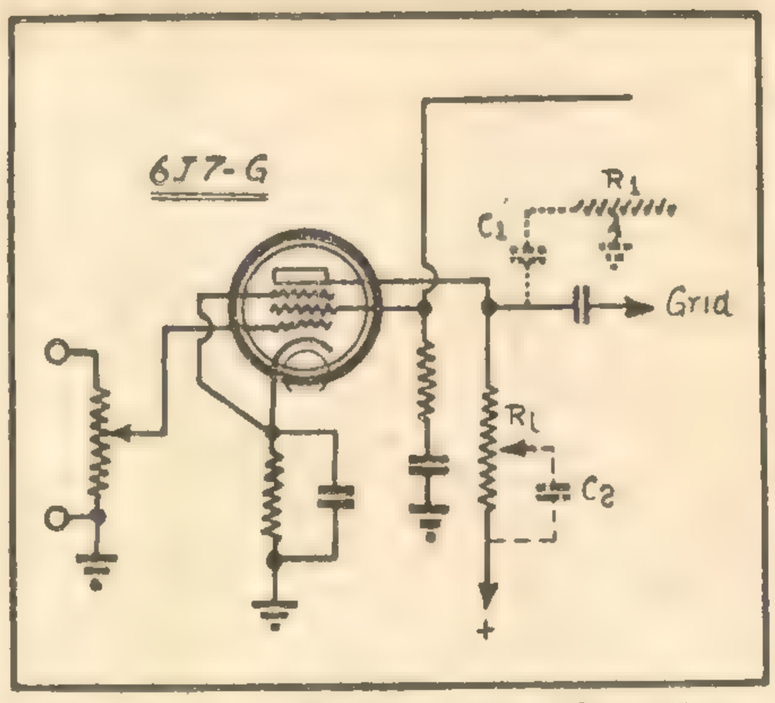


Figure 1. Showing two alternative methods of fitting a tone control to the 13W. amplifier to give treble attenuation.

However, switching is generally less preferable than a continuously variable control, utilising a single condenser and a potentiometer. In the above figure we have redrawn the first stage of the 13-watt amplifier; alternative tone control arrangements are shown.

A 1.0 meg. potentiometer (R1) may be wired in series with a .005 mfd. condenser (C1) between plate and earth. Alternatively, the regular 0.25 meg. plate load resistor may be replaced with a 0.25 meg. potentiometer, a .005 mfd. condenser being connected between the tapping and one side.

In either case, see that the potentiometer is wired in such a way that the taper allows a smooth control of treble attenuation. The associated condenser has to be fairly large in order to offset the effect of the feedback, which tends to resist any artificial departure from a sensibly level frequency characteristic.

There is little to choose between these schemes, and you can try the one which happens to suit the parts on hand.

During the past year we have made quite extensive use of a tone control system which permits treble boost or cut to be obtained with the one control. In order to include this in the 13-watt or similar amplifiers, it is necessary to rearrange the circuit as shown below.

MODIFIED CIRCUIT

Instead of the feedback being taken from the plate circuit of the UPPER valve and applied to the SCREEN of the voltage amplifier, it has to be taken from the plate circuit of the LOWER valve and applied to the PLATE of the voltage amplifier. The conventional scheme can then be used. Note that a .002 mfd. condenser has been added in the plate circuit of the upper valve to ensure stability under all conditions.

We made a brief check on the operation with the aid of a BFO and CR oscillograph. As might be expected, the phase relationship of input and output changes somewhat as the control is varied, but not sufficient to cause instability.

With the tone control advanced towards the treble boost position, some high order harmonic distortion could be detected. Under ordinary circumstances, the amplifier is not used with the control in the treble position, since the rising high note response is neither pleasant nor necessary.

However, for items which give the impression that the microphone and speaker have been securely wrapped in felt, a degree of treble boost and even a few high order harmonics (if perchance they are apparent under ordinary listening conditions) give a touch of life to otherwise dead and woolly reproduction.

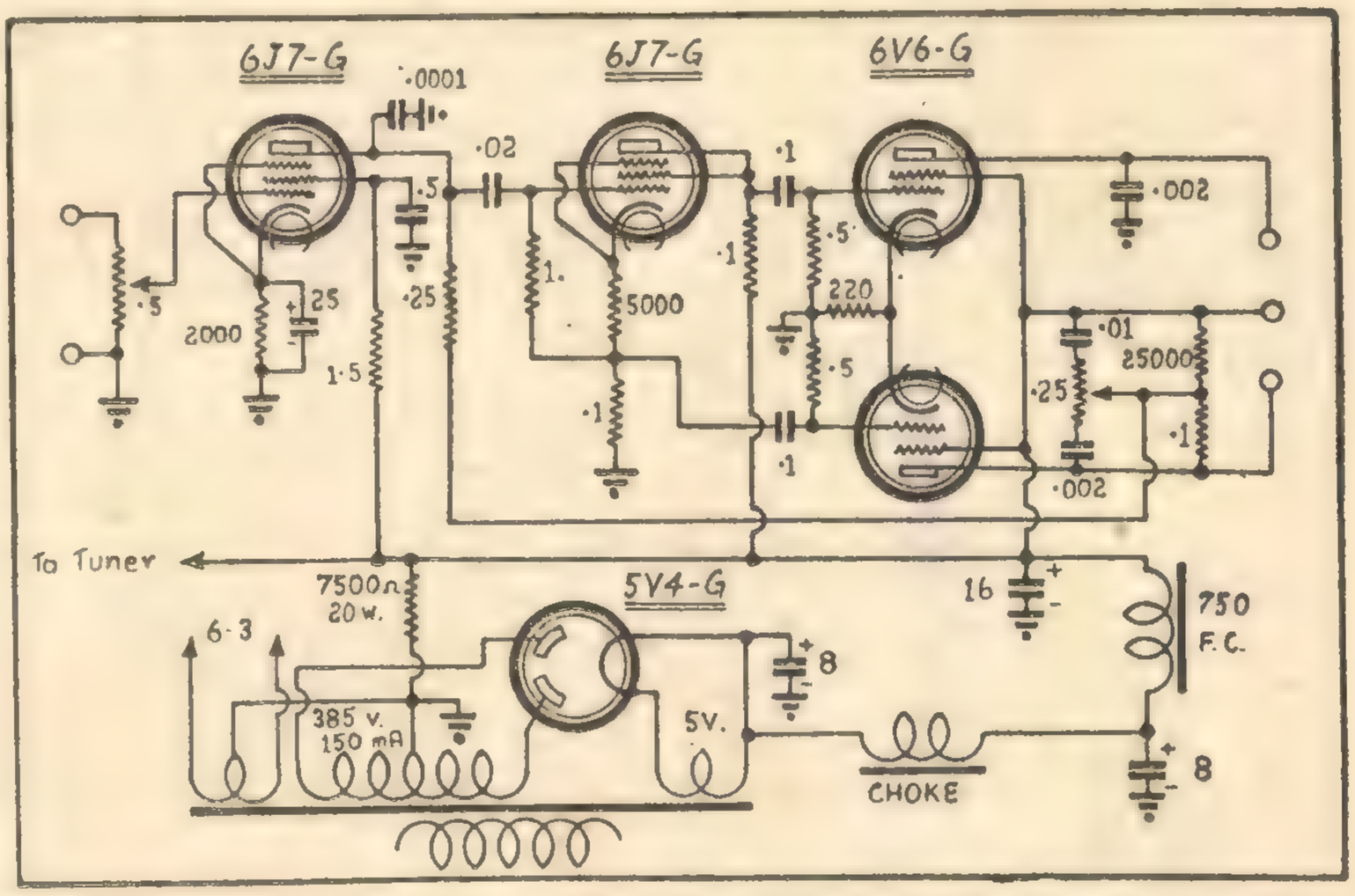


Figure 2. Here is the original 13W. amplifier circuit, modified to incorporate a tone control which permits either treble boost or treble cut.

TRADE NOTES AND NEW RELEASES

NEW PRICE LIST FROM THE ROLA CO.

The Rola Company has recently issued abridged specifications and a new price list for their loudspeakers. Also listed are prices and consignment instructions for speakers forwarded to the Melbourne or Sydney depots for repair.

The following explanatory notes accompany the price list, which is current as from August 21, 1942:—

All speakers are fitted with isocore transformers except G12 and K5, which are fitted with their own special types.

Prices relate to speakers with standard field coils and transformers. Prices for special specifications will be quoted on request. When ordering, state field coil resistance (in the case of electro-dynamic speakers) and impedance of matching transformer. When requesting a transformer to match an output valve or valves, give operating conditions. When permanent magnet speakers are to be used with power operated receivers or amplifiers, please signify.

ELECTRO-DYNAMICS:

Type No.	Overall Diam.	Voice Coil Diam.	Voice Coil Impedance.	Normal Field Excitation.	Maximum Weight of Field Coil.	Price.
G12	12⅛in.	1⅜in.	8 ohms	18 watts	3½ lb.	£9/10/-
K12	12⅛in.	1in.	2.3 „	9 „	2 „	55/6
F12	12⅛in.	1in.	2.3 „	8 „	1½ „	45/6
K10	9⅞in.	1in.	2.3 „	9 „	2 „	52/1
F10	9⅞in.	1in.	2.3 „	8 „	1½ „	44/5
K8	8⅛in.	1in.	2.3 „	8 „	1½ „	38/3
F8	8⅛in.	⅝in.	3.7 „	6 „	¾ „	31/9
F5B	6⅞in.	⅝in.	3.7 „	6 „	¾ „	31/8
K5	5in.	⅝in.	3.7 „	3.5 „	¼ „	27/9
PERMAGS:						
12/20	12⅛in.	1in.	2.3 „	—	—	54/6
10/20	9⅞in.	1in.	2.3 „	—	—	53/5
8/20	8⅛in.	1in.	2.3 „	—	—	51/-
6/12	6⅞in.	⅝in.	3.7 „	—	—	41/5
5/9*	5in.	⅝in.	3.7 „	—		34/3
5/4*	5in.	⅝in.	3.7 „	—	—	28/9

*With compact Isocore transformer detached for chassis mounting.

LEADS:

20in.			10in.	
K12	K8	..	F8	6/12
F12	12/20	..	F5B	5/9
K10	10/20	..	K5	5/4
F10	8/20	..	—	—

F12, F10 and F8 are supplied only to special order.

LOUDSPEAKER REPAIR SERVICE

RAPID expert repair service is provided at the Melbourne factory and Sydney Service Depot. Speakers for repair should be consigned, freight paid, to either:—

Rola Company (Aust.) Pty., Ltd., The Boulevard, Richmond, E.1, Victoria (consign to Burnley railway station); or Rola Company (Aust.) Pty., Ltd., 116 Clarence-street, Sydney, NSW.

All packages should be plainly marked with the name and address of the consignor, and an advice note despatched by the same mail, enclosing remittance and specifying the work to be done. Give forwarding instructions for return. If remittance does not reach us before despatch of repair, package will be sent by COD post or rail.

The following prices are effective immediately and are subject to amendment without further notice.

PRICE LIST OF PARTS AND REPAIRS:

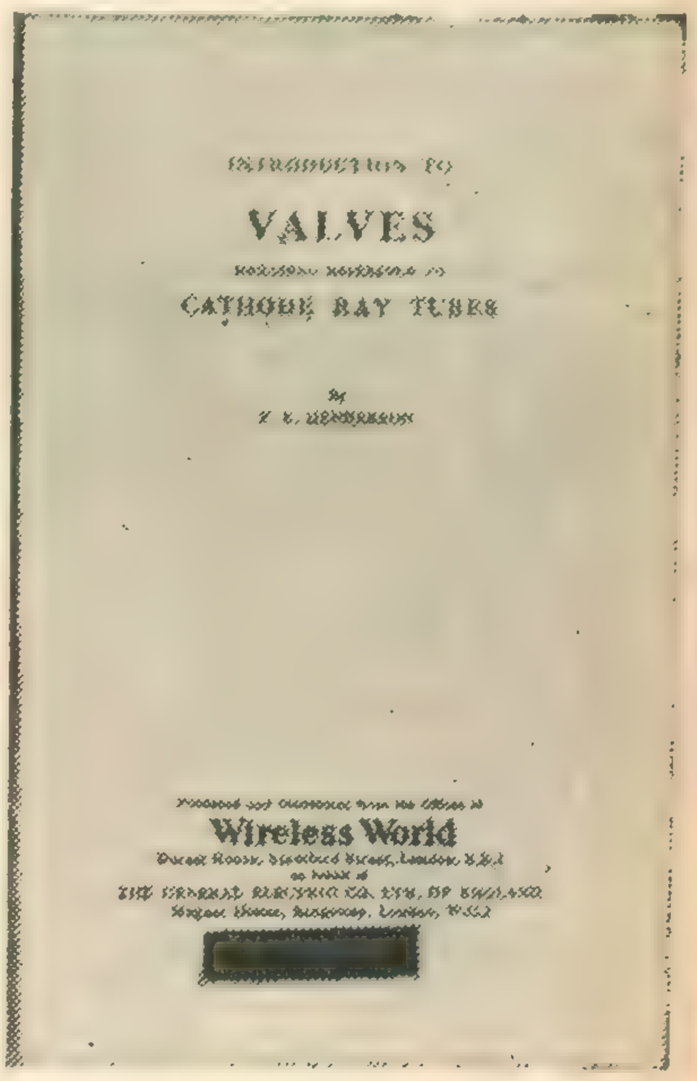
Model.	Diaphragm.	Field Coil.	Field & Diaphragm.	Transformer.
G12	42/4	52/7	67/4	16/10
K12	16/4	19/-	27/-	12/3
F12	16/4	13/5	22/5	12/3
K10	12/-	19/-	24/1	12/3
F10	12/-	13/5	17/10	12/3
K8	11/-	13/5	17/4	12/3
F8	11/-	10/8	14/8	11/3
F5B	8/7	10/8	13/11	11/3
K5	6/9	10/2	11/9	10/9
G12 PM	42/4	—	—	16/10
12in. PM	16/4	—	—	12/3
10in. PM	12/-	—	—	12/3
8in. PM	11/-	—	—	12/3
6in. PM	8/7	—	—	11/3
5in. PM	6/9	—	—	11/3

"INTRODUCTION TO VALVES"

By F. E. Henderson

FROM McGills Agency, Melbourne, we have received a copy of the latest publication from the offices of the well-known "Wireless World." Full title of the new book is "Introduction to Valves, Including Reference to Cathode Ray Tubes." Author is F. E. Henderson, AMIEE, of the Osram Valve Department of the GE Co., England.

Comprising just over 100 pages in all, the book is written in a clear and concise style. It is scarcely a book for absolute newcomers to the field of radio, although such could follow it, given plenty of concentration. Those who have acquired a certain familiarity with technical terms and practice should, however, find the book extremely valuable.



Chapter 1 opens with a discussion of the nature of electricity and, thereafter, it passes on to diodes, triodes, tetrodes, pentodes, &c., giving due consideration to the characteristics and peculiarities of each.

There are sections on directly and indirectly heated cathodes, valve noise, and so on, and a considerable proportion of the space available is devoted to the functions of valves in relation to receiver and amplifier circuits.

The last twenty-odd pages are devoted to gaseous rectifiers and control valves, cathode ray tubes and their application, time base circuits, and current and voltage stabilisers.

The matter is supported throughout with circuits, graphs and mathematical expressions, which, generally speaking, are easy to follow.

Our copy from McGills Agency, 183 Elizabeth-street, Melbourne. Price 7s 6d, plus 4d postage.

NEW BOOKLET
FROM THE A.R.R.L.

WE have received from the American Radio Relay League (ARRL) a copy of their latest publication, "Learning the Radiotelegraph Code."

Authored by John Huntoon, acting communications manager of the ARRL, the publication is designed to assist the many thousands of people who, for one reason or another, desire to become proficient in Morse code.

Based on the latest aural system of study, the discussion is intended to fit in with the methods of teaching adopted by the armed forces. Much of the matter is drawn from previous ARRL publications, including the special defence edition of the ARRL Handbook.

The publication begins with a chapter on learning the code and methods of lettering. Then follows a chapter on sending, practice cipher griups, and, in addition, some notes on high speed work and copying by typewriter.

There is a chapter on operating procedure, abbreviations, &c., and the book finishes up with a few circuits of code practice sets, hints on class instruction, and sending and receiving exercises.

Exclusive of advertisements, the publication contains 34 pages of editorial matter.

We understand that orders have been placed for this booklet, but that no stocks have yet arrived in Australia. It is anticipated that it will sell here for about 2s 6d, although this is quite indefinite.

RADIOTRON DESIGNERS HANDBOOK

WE have received advice from the Amalgamated Wireless Valve Co. that a further 5000 copies of the Radiotron Designer's Handbook have been printed. This brings the total number of copies to date to 47,000 in Australia, America, and Great Britain.

The whole of the new impression is cloth bound and copies will sell for 5s. Trade discounts will be as for the earlier paper bound copies. The cloth binding offers greater durability and allows the book to be opened flat on the table. No one having any contact with the theoretical side of radio should be without a copy of this popular manual.

LISTENERS' LICENCES

LATEST return of broadcast listeners' licences made available by the Postmaster-General (Senator Ashley) disclosed an increase of 4377 for the month of November. The total number of licences in force is now 1,335,336.

Since the passing of the Australian Broadcasting Act, which became operative in July, 1942, 23,560 supplementary licences have been issued for receivers in excess of one. Only 1367 licences have been issued for motor car radios.

Licences for additional receivers in homes, however, continue to increase, and the department had encountered cases where no fewer than six receivers had been licensed in the same home.

Work Out Your Own Maths Problems

(Continued from Page 27)

Mind you, the information imparted by the curve would not be altered, whichever way it were drawn, but the appearance to the casual observer would be quite different. Next time you have occasion to compare the frequency response of two similar units, take care to make allowance for any differences in the scales used.

Perhaps the widest application of graphs to radio work is that in connection with valves. It would be quite hopeless to record all the data available for different valve types in the form of tables. However, in a very small amount of space, a few graphs will show it all, not only giving one the necessary information, but also making it possible to see at a glance the shape and peculiarities of the characteristics.

PLATE FAMILY OF CURVES

The best known of all valve characteristic curves is the so-called plate family of curves, which gives the value of plate current drawn with various values of plate and control grid voltage. In Figure 6 is shown the plate family for type 45.

Note that there are quite a large number of curves to be seen, in contrast to the single curve, to which we have thus far limited our discussion. The large number of curves need not worry us, however, for each one is quite separate and represents the plate current versus plate voltage relationship with definite and stated values of grid bias.

The curve on the extreme left is that for zero grid bias. With a plate voltage of 80, we find that the plate current is about 37 milliamps. Note that it is necessary to interpolate to obtain this value.

The next curve in order represents a grid bias of —10 volts. With a plate voltage of 80 and a grid bias of —10, the plate current is only about 14 milliamps, as compared to the 37 milliamps under the zero bias condition.

If we happened to want to know the plate current with a plate voltage of 80 and a bias of, say, —5.0 volts, it would be necessary to interpolate with respect to the grid voltage lines, perhaps pencilling in a small portion of a curve which, to the eye, appears to be halfway between 0 and —10 volts.

OTHER GRAPHS

Thus, if any two of the factors in question are known, the plate family of curves allows the third to be determined.

There are other types of curves commonly published for triode valves, but these cannot all be discussed here. Sufficient to say that the constants, which are being correlated, are usually clearly marked.

Some may be wondering as to the significance of the heavy load lines marked on the curve of the 45 valve. These lines indicate to the engineer something of the operation of the valve as a power amplifier.

The use of valve curves to obtain data on power output, distortion, stage gain and other dynamic functions is quite in addition to the elementary business of providing information on currents and voltages. However, we are getting into rather deep water.

Before attempting to read or use valve curves, always examine the curves to see if there are any governing conditions under which the curves were drawn. This does not apply so much to a triode plate family of curves, but it does apply to other triode curves, which may be drawn for specified plate of grid voltages.

PENTODE CURVES

The plate current curves for a pentode are quite different in appearance to those of a triode. As we have already explained in connection with Figure 4b, there is a sharp knee in the curve, either side of which it is reasonably straight. The reason for this does not concern us here.

Pentode curves are always drawn for certain stated values of screen voltage. Thus, they can only be used to find values of plate current if the screen voltage for which the curve was drawn happens to coincide with that in which we are interested.

Manufacturers provide all kinds of curves for pentode valves. Many of these are intended mainly for receiver designers, but the average enthusiast can often obtain from them elementary data not published in the valve data chart.

Figure 7 shows the plate family of a tetrode valve. The pronounced kink in the characteristic, actually due to secondary emission, is quite noticeable. This amply illustrates our previous statements about guesswork when drawing curves.

If one had plotted the points along the straight portion of the curve and then a few points in the immediate vicinity of zero plate volts, one might have been tempted to draw in a smooth curve, similar to that obtained with a pentode.

Obviously, this would be quite wrong and the pronounced kink in the characteristic, together with its exact shape, would only become apparent by careful plotting of points over the region in question.

IN CONCLUSION

Well, we have already sorely taxed the generosity of the editor in regard to space, so the story of graphs will have to be left there. We have merely touched on the fringe of that very vast subject of valve data curves. Perhaps, at some later date, we may be able to prepare an article on the subject.

In the meantime, we hope that the foregoing will prompt you to take out your valve data handbook and spend an hour or so finding out what you can about those mysterious curves.

THE MONTH ON SHORT WAVES

by Ted Whiting

POOR RECEPTION CONDITIONS

During the past couple of months, and in particular the last week or so, reception conditions have been very poor at certain times. During those periods when we are accustomed to hearing our favorite station at its best level, we have found conditions disappointing and the station to be heard only with difficulty.

MUCH of the trouble has been due to the sun spot activity, and has affected the Pacific service to such an extent that at least one whole programme had to be repeated during the Christmas period.

We are hoping that this high noise level has now spent itself, and that very soon we will be able to listen in comfort to such stations as XEWW and the many South Americans which are on the air on Sunday afternoons.

Reception at the early part of the evening is now better than it was when we last wrote these notes, and will soon recover, so that we will be able to play the many stations to be heard at good level.

At the time of writing, reception during the very early hours of the morning is excellent. In fact, we have heard some very fine signals from all of the continents of the world. The Daventry stations excel at these hours, and some very fine programmes are to be heard A night spent at the receiver is well rewarded at these times.

There is a distinct possibility that soon we may find that there will be changes in the schedules and the stations operating the various services of the BBC. We feel that there will be many alterations in the Pacific service in order to maintain continuity in transmission, which just now is very poor at its beginning.

S/W REPORTS

Owing to the conditions prevailing at the present time, we would impress on our readers the importance of getting their logs in to us at the published date. On many occasions we have had to hold over interesting items due to their late arrival, and as a result the information has been weeks old by the time it reaches the bookstand. In addition, we would ask all reporters to include in their reports the time observed in the compilation of the report.

We would draw our readers' attention to the fact that there is a new African to be heard in the early morning. This one is the new frequency, which we have written about for some time. The station is VQ7LO, located in Kenya. There are many who have not up to the present added a South African to their list, and who will be glad of the opportunity of hearing such a fine signal to open their account.

RUSSIAN STATIONS

OUR readers will notice that we rarely comment on the many Russians which are to be heard on the various bands each day. This reluctance is due to the fact that these stations are rarely on the same frequencies for any length of time, and by the time these notes are seen in print the station which we regarded as a pearl is gone with the wind, or whatever stations go with. Moreover, these stations are often very hard to recognise, due to the language used, and we are apt to spend many hours listening to a station which does not yield any material information. However, if there are any of our readers who spend a lot of time chasing these stations, we will be only too pleased to report their observations for your benefit.

A brief resume of the transmission is all that is required, together with the language used, and the time of operation.

ITEMS OF GENERAL INTEREST

MYSTERY STATIONS

FROM time to time we find that there are many stations which are very difficult to identify. We list these each month so that they will be in time taking their place in our list, making it as complete as possible.

A German station is heard at 7.30 am at very good strength on 48.14m. This one is heard as late as 8.30 am when conditions hold.

The next one is heard at 7.45 am, with lady announcer, operating on 45.10m., and with musical programme following at 8 am.

At 7.5 am a station is heard using either Portuguese or Spanish, with both male and female announcers. The wavelength used is 52.20m.

In New Zealand Mr. Cushen is hearing a station which is believed to be a South African operating on 9840kc. The national anthem is played, and then the news is given in Portuguese. Programmes in English. Portuguese and French follows. Can anyone give us a lead as to the identity of this one?

NEWS FROM U.S.A.

Mr. Condon was very fortunate in receiving a copy of "Universalite" from the USA, and he has been good enough to forward us the following details, which we print with due acknowledgment to both "Universalite" and Mr. Condon.

The German operating on 25.15m., is using the call DJZ. An Italian is heard on 25.11m., call letters assigned 2RO22. 2RO24 is the call of the Italian heard on 29.04m.

The German authorities have changed the call of the old PCJ Huizen, Holland. This station is now heard as DXL15.

A further Italian is heard on 47.60m., and is called 2RO23.

The Cuban station which we have been hearing on 30.49m., using the call COBC, is now reverting to its old frequency of 32.05m.

All these stations will be found listed in the station list, under these changed calls and frequencies, in order that readers will be able to bring their lists up to date.

NEW B.B.C. STATIONS

IN a list published by the BBC we find that there are three particular stations included two of which we know nothing about.

These stations operate on 2915kc, and 6010kc. We would like to hear of the details of these stations, which have as yet never been heard here. The third station is the one which we reported as operating on 17.715kc., 16.94m. This station is heard at fair strength at 9 pm. They are on the air from 7.45 pm till 9.45 pm in a transmission for Europe. News is given in English at 8 pm and at 9 pm in German. The call is GRA.

The new transmitter in the Eastern service, GVO, 18.080kc., is also heard well.

Reports for the March issue should reach Mr. Ted Whiting not later than Saturday, February 6th, 1943. His address is 16 Louden-street, Five Dock, NSW.

WHEN AND WHERE TO LISTEN

6 A.M. TILL NOON

TPZ2, 8960kc, Algiers. Heard well at 6 am.
GRY, 9600kc, London. Heard at good level at 6 am.
WGEO, 11,847kc, New York. Good one at 6 am.
DXJ, 7240kc, Berlin. Very fine signal at 6.15 am.
CR7BE, 9845kc, Lourenco-Marques. Heard well at 7 am.
KWU, 15,355kc, San Francisco. News at 8 am.
WRCA, 11,893kc, New York. Listen at 8.30 am.
Batavia, 18,135kc, Java. News and music at 9 am.
WDO, 14,470kc, New York. Heard well in English at 9 am.
Best listening period at from 6 am till 8 am.

NOON TILL 6 P.M.

Batavia, 18,135kc, Java. The best signal on at 1 pm.
Moscow, 15,110kc, Russia. Good one at 2 pm.
VUD3, 15,290kc, India. News at 2.30 pm.
GRH, 9825kc, London. Very good at 3.30 pm.
2RO3, 9630kc, Rome. Signal outstanding at 4 pm.
XEWW, 9503kc, Mexico. Heard at variable strength at 4.30 pm.
FZI, 11,970kc, Brazzaville. News in French at 5 pm.
KWV, 10,840kc, San Francisco. Heard well at opening at 5 pm.
WNBI, 9670kc, New York. Good at 5 pm.
Best listening period at from 4.30 pm till 6 pm.

6 P.M. TILL MIDNIGHT

KWID, 9570kc, San Francisco. Very good at 6 pm.
FK8AA, 6160kc, Noumea. Very good in English at 7 pm.
GRX, 9690kc, London. Heard well at 7.45 pm.
WGEO, 9650kc, New York. Fine signal at 8 pm.
TAQ, 15,195kc, Ankara. Listen for this one at 8.30 pm.
DJR, 15,340kc, Berlin. One of the best at 9 pm.
KZRH, 9640kc, Manila. Heard the last few weeks at 9.30 pm.
2RO24, 15,480kc, Rome. Good one at 10 pm.
FFZ, 12,070kc, Shanghai. Fine signal at 11pm.
XGOY, 6130kc, Chungking. Excellent at 11.30 pm.
Best listening period at from 7 pm till midnight.

FLASHES FROM EVERYWHERE

BRAZAVILLE.—Our old favorite, FZI, s at long last to commence radiating on additional frequencies, according to a letter received recently from them. The only thing that they forgot to mention was the detail of their new service. However, our reporters will overcome that obstacle.

CHILE.—For some time we were having a very hard time with CB1180, but that period is now past, and they come in regularly, backed up by their power of no less than 1000 watts. Their antenna is placed in a north-south direction, as the station is intended not as a world-range transmitter, but as a service for the people in that narrow strip of land, of which Chile is formed. CB1180 relays the programmes of the B/C station, CB57.

COSTA RICA.—Whenever old hands at this game of short-wave listening get together, the conversation always turns to that old station, TI4NRH. This station has made what must be an all-time record for a station being on the air for such a long time, and under the same ownership. Our old friend, Cesedes Marin, is still at the helm, and can be heard regularly. He is using a power of 500 watts. A correct report to this station brings a very nice reward.

GUATEMALA.—Stations from Guatemala are now to be heard, and as the year becomes more mature, they will be heard at much better strength. We are advised by Mr. Condon that the address of TGWA is Radiodufusora Nacional De Guatemala, La Voz De Guatemala, Guatemala City, Guatemala.

SYRIA.—Radio Levant is also heard well these days, and Mr. Condon has received from them a letter stating that they will verify in letter form in the absence of cards. Their radiation takes place in the north-westerly direction, and so it is amazing that at times they are heard at such good strength.

MADAGASCAR.—We have several reports of better reception coming from this much-discussed island. Their frequency is now being heard well in the west on 9690kc. We have been looking for them on this band for some time, but as yet we're out of luck. However, now that they are breaking through in Western Australia, they will be shortly heard here. This station is easily recognised, as they give their station announcements at regular intervals. The language is French, and a male and female announcer are heard.

THAILAND.—Also from Mr. Nolan, in WA, comes the information that there is a station heard signing as HSP2, and operating on 19100kc. (approx.). This one is being heard at 8 pm till 9 pm, and is said to be usually calling Berlin or JBE, Osaka. They have also been heard at 11.15 am in an Asiatic type programme. However, their transmission is usually in English.

BATAVIA.—We have received advice that the name of this country has been temporarily changed into "Jarcutta." Mr. Keast has heard this name used several times, but we hope that by the time we get to hearing it, it will have been necessary to change it. It seems rather a shame to us that these people were not able to find a more original name.

ALGIERS.—The transmitter, which operates on 8960kc., 33.48m., has been heard using the call OWI. This seems to be when on the air and in communication with America. The station is now, of course, under American control, and is used extensively for contacting WDO, when talks are radiated for transmission over the USA networks. This contact is made at 10 am for those who are lucky enough to be able to hear them. The transmission of TPZ2 is still carried out, and is audible here.

THIS MONTH'S VERIFICATIONS

AS usual, we have heard from several of our reporters, who are having the best of luck in their hobby of collecting those cards, and in fact we are anxiously awaiting the mail man to bring us a few new ones. We only hope that they are marked "First in Australia."

SWITZERLAND.—Mr. Cushen follows up his success of last month with the reception of two cards for HER3 and HBH. These cards only took one year and two years to get to him, but were well worth while since he was advised that the station staff were amazed that he should hear HER3 at all, since the transmission is only intended for reception in the European periphery, and is therefore devoid of any directional transmission.

AMERICA.—That ace listener and reporter of the North, Dr. Gaden, has again received some more veri's. This month his swag comes from KWID, for both their transmissions on 19 and 31m. As if this was not sufficient, he also received cards from FZI and CB1180. This one he considers his best for the month. In addition, he has also cards from five B/C stations. Better luck next month, Doctor.

GUATEMALA.—Mr. Moore is now the very proud possessor of a very nice card from TGWA, which he received recently. This one will soon be heard well, so there should be a few of them around.

SHORT WAVES

NEW STATIONS OF THE MONTH

CHINA — ENGLAND — AFRICA — AMERICA — AUSTRALIA, &c.

XGOY CHUNGKING

THIS month, as a relief from the customary array of American transmitters, we have a change inasmuch as we report on a new one heard from China. This is one of the familiar group of stations which are heard so well operating under the call XGOY. This new outlet is to be heard on 6135kc., 48.90m. calling San Francisco at 11 pm. This station has been heard to remain on the air until 11.30 pm. There is quite a lot of Chinese type music broadcast, but it will be found that English is used liberally. The first report was received from Mr. Condon.

GRA, LONDON

In connection with this station, which by now most of us are hearing, we have an apology to make. Although the details of this one were in our notes, we find that they were omitted from the final publication of these pages. Early in the month (December), Mr. McKinnon kindly told us of a new BBC transmitter, which he was hearing nightly at the top of the 16-metre band. This station has been heard here each night since, and is heard to take the news at 10 pm. Previous to this they are on the air in a service in European languages, and after the news they resume this transmission. We, therefore, presume that they are engaged in the European service. The frequency is 17,715kc., 16.94m.

VQ7LO KENYA

The new African frequency of which we have written during the past few months is now in operation, and may be heard daily at from 3|15 am till 5.15 am. The signal is an exceptionally good one from this part of the world, being rivalled here only by Tananarive. The frequency is a little different from what we expected, but is on 10,730kc., 27.96m., and is heard about three points better than on 6060kc.

WNP NEW YORK

The usual crop of Americans is augmented by this one heard at 9 pm in relay with KWID until 10 pm. They are to be heard on 8810kc., 34.05m., and come in here at very good level.

WDO NEW YORK

Another one is WDO, which we think has been heard by most of our readers. This one is reported to us by Mr. Gillett, who hears them at 8 am till 9.30 am on their assigned frequency of 14,470kc., 20.73m. Since this one is in the clear, they are easily recognised.

VLG8 MELBOURNE

A new outlet used in the service to western USA from 2 pm till 2.45 pm is using the old frequency of VLQ8. This one is heard very well here in this transmission. The frequency is of course 17,800kc., 16.85m.

2RO? ROME

We have heard another new outlet from Italy, which we think is one of the mystery stations of which we have had so many reports. This one is heard on 19.36m. at 11.40 pm with a very good signal. We hope that by next month we will be able to give the call letters designated to this one. The programme radiated is directed to Great Britain and is in English.

THAILAND RADIO

This one has been heard at good level operating on 6057kc., 49.53m. The service given is the same as that heard from HS7PJ, which operates on 825kc. This station is reported to us by Mr. Condon, who must be in a very good location for stations from the east. This one is heard at 12 midnight.

VUD? DELHI

Another new outlet from the All India Radio is heard at midnight in parallel with the transmitter operating on 9590kc. This outlet is heard on 6005kc., and at this location puts in quite a respectable signal. As yet we have to learn the new call letters.

HARBIN, MANCHUKUO

Another station from the east has been heard at the midnight hour. The Harbin Broadcasting Station, which we think is a relay of a B/C station, is audible for about two hours on their frequency of 6030kc., 49.75m., in a programme of a foreign nature.

VLN3 SYDNEY

Our local authorities have evidently found that some of the old frequencies were not giving the service they used to. The result is that we have a new one heard in the transmission to USA from 2 pm till 2.40 pm. The details are 18,495kc., 16.22m., and has displaced the new one in VLN8, which was used for some weeks. This one is a good signal here, and we would welcome report from the more distant centres.

WBOS BOSTON

This one has been heard using a new frequency at 8.45 pm. The station closes at 9 pm. The details are 6143kc., 48.85m. The strength of this one is good here, but at the location of Mr. Condon is much better.

WHL5 NEW YORK

The New Yorker with the unusual call letters is heard by the same reporter operating on 9904 kc., 30.29m., at 9 am daily with what he claims to be a fair signal. As yet, he is the only reporter who mentions this one. We will listen for them at the first opportunity. If this one is on the air for any length of time, it will provide a good signal in the next few months.

PONTA DELAGA

Some months ago we were able to listen to Emissora Nacional, operating on a frequency of 7305kc. The latest advice from Mr. Condon states that they are now to be heard on 7010kc., 42.80m. The language is, of course, Portuguese, and the time is indicated by the striking of a clock chime. This one is, by the way, about the most distant station to be heard from this part of Australia.

WITH OUR SHORT-WAVE REPORTERS

MR. R. CHURCHER, DAVENPORT, TASMANIA

IN the last 18 months we have read of the listening posts operated by our readers, located in various parts of the continent and in New Zealand, but, up to the present, we have not had the pleasure of reading of the exploits of a listener from the "Apple Isle."

Therefore, we are pleased to tell you of Mr. Churcher, of Devonport.

TWO RECEIVERS

The receivers operated here are of entirely different nature, one being of a popular type, using a five-valve circuit. The coils are switched, and three bands are used, covering from 12 to 140 metres. Most of the listening at this post is done on this receiver, but at present a four-valve TRF receiver is also in operation. This will, in the near future, be scrapped to make way for a "Dual Wave Advance," which is under construction.

The old favorite aerials, of the inverted L type, are used on both receivers, a separate system being provided for each receiver. They are both slung in a north-south direction, 40 feet high.

Earths are provided for each set, and assist in making reception a little easier in a district which is fraught with noise. There seems to be every kind of noise-producing device in the locality of this post, and it is found that the installation of earths give very good results.

The collection of verifications is not a hobby of Mr. Churcher's, but he has logged no fewer than 103 stations, located in 21 countries. This is very commendable, inasmuch as he has only been pursuing the hobby over the past six months. However, reports are out for several stations, and we hope to report in the near future that Mr. Churcher has yet another card.

"Radio and Hobbies" has great appeal in Devonport, and Mr. Churcher's favorite sections are, "New Stations of the Month. With Our Short Wave Reporters," and "This Month's Verifications."

This is the story of one of our younger reporters; he is only 16 years of age, and he has already constructed many of the receivers described in this magazine in the past. We all hope that he will continue to add many new stations to his list.

OVERSEAS S.W. STATIONS NOW AUDIBLE

The list of stations shown below comprises only those which have actually been heard in this country during the past few weeks, and does not include stations which are on the air but not heard as yet in this country. A large majority should be heard on any sensitive receiver, and when a station is reported for the first time readers' names who report it are shown in brackets. At the end of each group is a list of correspondents who have sent in reports.

ENGLAND

GSA—60550kc. 49.59m. London. A good signal in the Home and European services at 6 am and 5 pm.

GSB—9150kc. 31.55m. This one is to be heard in the Eastern, Pacific and Latin American services daily.

GSC—9580kc. 31.32m. Very good signal in the N. American service from 9 am till 3.45 pm.

GSD—11,750kc. 25.53m. Heard well whenever on the air. In use in the African, N. American, Pacific and Eastern services.

GSE—11,860kc. 25.29m. This transmitter is only heard at intermittent periods. Has been heard at 6 pm.

GSF—15,140kc. 19.82m. Another regular which is heard well in the African, Pacific and Eastern services.

GSG—17,790kc. 16.86m. A very good one in a transmission in the French language opening at 9.30 pm. This one is also heard at 3 pm in the Pacific service.

GSH—21,480kc. 13.97m. Is being heard at most locations now on opening at 9.45 pm in the Eastern service. Good signal most nights.

GSI—15,260kc. 19.66m. Heard well in Pacific service at 6 pm daily.

GSJ—21,530kc. 13.93m. This outlet is not to be heard here this year. It may become audible at time goes on.

GSL—6110kc. 49.10m. Yet another outlet of the Pacific service from 4.45 pm daily.

GSN—11,820kc. 25.38m. This transmitter is used in the foreign language service of the BBC. Heard here in the European service at 7 am and at 12.30 am. Also in foreign service at 11 am. This is being heard at some locations.

GSO—15,180kc. 19.76m. Heard at 11.15 pm in foreign language service. French and Italian have been heard recently.

GSP—15,130kc. 19.60m. A weak signal in the Pacific service.

GST—21,550kc. 13.92m. This is yet another that may be heard as the summer passes. We have not heard them as yet.

GSU—7260kc. 41.32m. Does not appear to be in service these days.

GSV—17,810kc. 16.84m. Good signal in Eastern service from 9.45 pm to 12 midnight.

GSW—7230kc. 41.49m. This one is heard in the European service at 6 pm. Good signal at times.

GRD—15,450kc. 19.42m. Pacific service at 7 pm and in the African service at from 3 am

GRE—15,390kc. 19.49m. A very good signal in the Eastern service at opening at 9.45 pm.

GRF—12,905kc. 24.80m. This one is weaker now in its Latin American transmission at from 8.30 am till 11 am.

GRG—11,680kc. 25.68m. This one is used in the African and N. American services at from 6.30 am and 7.45 am.

GRH—9825kc. 30.53m. Another good one in the N. American service at 8.15 am.

GRI—9415kc. 31.86m. Another one which is heard irregularly. Was used in a transmission in French during the North African invasion Good signal here.

GRJ—7320kc. 40.98m. European service at 7 am daily. In a Spanish transmission at from 6 pm till 6.15 pm

GRK—7185kc. 41.75m. Is used in the Home service only. Can be heard at this location at good strength at 4 am and 7 pm.

GRM—7225kc. 42.11m. A transmitter which is now being heard in a French transmission at midnight.

GRN—6195kc. 48.43m. Heard when the noise will allow at 6 am. Is also used in the N. American service at 1 pm.

GRO—6180kc. 48.54m. A good signal in the African service at 4 am.

GRP—17,890kc. 16.77m. This one has been reported from S. Australia as heard at 11 pm.

GRQ—18,025kc. 16.64m. This one is not being reported this year.

GRR—6080kc. 49.34m. Yet another Home service station which is being heard at 3 am and 5 pm at fair strength.

GRS—7065kc. 42.46m. This is one of the Pacific service line-up. This last few weeks has been under a cloud of Morse.

GRU—9450kc. 31.75m. Used only in the African service from 2.30 am to 3 am. The signal is invariably a good one.

GRV—12,040kc. 24.92m. This one is heard in the Latin American service in the forenoon. Also heard in the Pacific service at 7.15 pm.

GRW—6140kc. 48.86m. This is the best of the Home service transmitters heard at this location. We hear them at 3 am and 6 pm

GRX—9690kc. 30.96m. Heard best at 7 pm in the news for Europe. Also on the air at 7 am.

GRY—9600kc. 31.25m. A good one in the African service at 6 am and in the N. American service at 7.45 am till 9.40 am.

GRZ—21,640kc. 13.86m. Is heard here at 10 pm in Eastern service; previously is heard from 9.15 pm in French. Good signal on a good night.

GRA—17,715kc. 16.94m A new one heard at variable strength from 7.15 pm till 10 pm daily. News is read at 8 pm in English and at 9 pm in German.

GVO—18,080kc. 16.59m. This one has been included in the Eastern service from opening at 9.45 pm. Heard well here.

The following readers have reported stations in the above group:—Messrs. Harvey, Larsen, Perkins, Nolan, Gaden, Smart, McKinnon, Wass, Lee, Keast, Gillett, Condon, Fluck, Moore.

INDIA AND ASIA

PMC—18,136kc. 16.54m. Batavia. This station is heard at 2 pm and 10 pm at good strength. POW news is heard at these times.

Voice of Batavia—8846kc. 31.92m. This one is reported as being heard in closing at 2 am.

VUD2—7290kc. 41.15m. Delhi. Heard best at 10.30 pm but is also heard well earlier.

VUD2—6190kc. 47.47m. Same location. This one is on schedule from noon till 2.35 pm. Heard at fair strength in country districts.

VUD2—4690kc. 60.48m. Same location. On schedule from 12.35 am to 3.15 am.

VUD3—15,290kc. 19.62m. Same location. This one is heard at 2.15 pm, 4 pm and 9.30 pm daily. Good signal at most times.

VUD3—11,830kc. 25.36m. Same location. This one is also heard at 11.30 pm daily.

VUD3—6085kc. 49.30m. Same location. Heard between the hours of 2.30 am and 5 am, when the signal reaches quite good level.

VUD4—9590kc. 31.30m. Same location. This one can be heard during the best part of the day. The strength is not so good here at this location.

VUD6—11,790kc. 25.45m. Heard between 6 pm and 7 pm and also 10 pm and 12.20 am.

VUD6—7270kc. 41.27m. Same location. Best time to hear this one is between 12.30 am and 5 am.

VUB2—7240kc. 41.44m. Bombay. Good at night in transmission at 11.30 pm.

VUB2—6085kc. 49.30m. Same location. This one is on the air at from noon till 2 pm daily.

VUB2—4880kc. 61.48m. Same location. On schedule from 1 am till 3.15 am.

VUM2—7270kc. 41.27m. Madras. This one is reported at good strength at from 2.30 am till after news is read at 2.50 am.

VUM2—6150kc. 48.78m. Same location. To be heard at from 11.30 am till 1.30 pm.

VUM2—4920kc. 60.98m. Same location. This one is on the air for the same period as the previous transmitter.

VUC2—7210kc. 41.67m. Calcutta. Heard well in news at 11 30 pm.

VUC2—6010kc. 49.92m. Same location. Yet another one which we cannot hear here as they are on the air from noon till 2 pm.

VUC2—4840kc. 61.93m. Same location. This one is also on the air at the same time.

????—9045kc. 33.17m. Kirkee. The service to Syria is still heard at 4.30 am.

Radio Shanghai—11,970kc. 25.06m. This station of the Indian Independence League is heard well from 10.30 pm till 1 am.

XGOA—9820kc. 30.86m. Chungking. This one is heard at from 10.30 pm till midnight. Good signal.

XGOY—11,900kc. 25.21m. Same location. Heard at good strength during the period from 7.30 pm to midnight.

XGOY—9635kc 31.13m. Same location. This one is not reported now but was heard testing some months ago.

XGOY—9625kc. 31.17m. Same location. Heard well on the news at midnight.

XGOY—5950kc. 50.42m. Same location. Audible at from 11.30 pm till 1.15 am, when news is read.

XGOX—15.200kc. 19.74m. Same location. Heard

NEW STATION LOGGINGS

THE following new stations have all been definitely heard and identified at our location since our last issue. Where call letters are not as yet known, station is listed under its location.

Call.	Kc.	W/L.	Location.
XGOY	6135	48.90	Chungking
GRA	17715	16.94	London.
VQ7LO	10730	27.96	Nairobi.
WJP	8810	34.05	New York.
WDO	14470	20.73	New York.
VLG8	17800	16.85	Melbourne.
2RO ?	15495	19.36	Rome.
?	6057	49.53	Thailand.
VUD ?	6030	49.75	Delhi.
VLN3	18495	16.22	Sydney.
WBOS	6143	48.85	Boston.
WHL5	9904	30.29	New York.
?	7010	42.00	Azores.
VLN8	10257	28 50	Sydney.
?	11724	25.59	Leopoldville, Belgian Congo.
ZOY	7284	41.20	Accra.
KWY	7560	39.68	San Francisco

carrying news in English at 8.30 pm daily.
XGOI—9300kc. 32.26m. Shanghai. This one is not heard these days, but is on the air at 10.30 pm.
XGOI—9665kc. 31.04m. Same location. This station is in parallel with the previous one. News is heard at 11.15 pm.
XGOK—11,650kc. 25.75m. Canton. Heard at from 11 pm. Usually rather weak.
XGAW—6090kc. 49.25m. Shanghai. Heard at 10.45 pm. American announcer.
XGRS—11,640kc. 25.77m. Same location. This German-owned station is still heard at 8 pm. English is spoken.
XPRA—9830kc. 30.51m. Kweiyang. Heard well at 10.30 pm.
XPSA—8465kc. 35.44m. Same location. The only programmes heard from this one are of the native type. Heard at very good strength at 7.30 am and at 10.30 pm.
XGAP—10,270kc. 29.20m. Peking. Heard nightly at opening at midnight.
XGAP—6100kc 49.18m. Same location. This one comes in at good level from 11.30 pm.
XYMA—9350kc. 32.09m. Shanghai. This one is still poor here. Reported as being heard well at 11.15 pm.
XMHA—11,855kc. 25.30m. Same location. Heard from 9 pm with good signal.
XIRS—11,980kc. 25.02m. Same location. Heard at 11 pm with fair signal. Also reported at some locations from 11 am until closing at 11.15 am.
XGEI—16,092kc. 18.65m. Kuoming. Has not been reported this month.
FFZ—12,060kc. 24.88m. Shanghai. Heard from 9.45 pm at good level. The Morse interference has eased somewhat.
JQHA—9470kc. 31.68m. Hongkong. Heard at most locations at from 11 pm till 2 am.
MTCY—15,330kc. 19.57m. Haingking. Heard one evening at 7 pm testing with Rome.
MTCY—????5kc. 25.48m. Same location. Heard at some locations at 9 pm.
MTCY—9545kc. 31.43m. Same location. Very good signal some days from 8 am till 9 am.
MTCY—6125kc. 48.98m. Same location. It seems that this transmitter is not in use.
MTCY—5740kc. 52.28m. Same location. Good signal in English transmission at 1 am till 2 am.
Saigon—11,780kc. 25.47m. This regular is heard at from 9.25 pm. Is also reported as being on the air at 11.45 am till closing at 12.25 pm.
CR8AA—6250kc. 48.00m. Macao, Portuguese China. Heard nightly in some locations.
HSP5—11,715kc. 25.61m. Bangkok, Thailand. Heard at 11 pm. Lady announcer with usual remarks.
Voice of Thailand—7190kc. 41.72m. Same location. Fair signal on closing at 12.45 am.
Thailand Radio—6044kc. 49.63m. Same location. This one is on the air every night at midnight.
EQB—6155kc. 47.74m. Teheran, Iran. English is used from this one at 5.45 am.
E??—8110kc. 36.99m. Same location. Also heard at the same time in English. French is also used until 8 am.
KYZ—6007kc. 49.94m. Rangoon. Heard at weaker level from 11 pm.
ZHJ—6095kc. 49.21m. Penang. This one is also under Jap control. News is English at 11.30 pm, fair strength.
JZL—17,780kc. 16.87m. Tokio. News is read at from 7 pm till 7.15 pm.
JZJ—11,800kc. 25.42m. Same location. This one opens at 8 pm. Also heard at 9 am.
JIE2—9695kc. 30.95m. Same location. Heard at 10.30 pm and 12.30 am in news in English. Lady announcer.
JXW—7257kc. 41.34m. Same location. This one is good signal at 7 am.
ZNR2—10,285kc. 28.88m. Aden, Arabia. This one opens at 3.15 am. Heard in the west at 4.45 am.
Radio Levant—8030kc. 37.34m. Beruit, Syria. Heard at good level at opening at 3.30 am.
Singapore—12,000kc. 25m. Heard at very good strength at midnight. Closes at 12.30 am with fair signal.

The following readers have reported stations in the above group: Messrs. Harvey, Larson, Shell, Bate, Morris, Perkins, Nolan, Grigg, Walker, Cushen, Johnson, Gaden, Smart, Lee, Teare, McKinnon, Hanson, Nicholson, Gillett, Condon, Fluck, Keast, Moore.

NORTH AMERICA

WGEA—15,330kc. 19.57m. Schnectady. News is read from here at 1.15 am. Heard at quite good strength.
WGEA—9550kc. 31.41m. Same location. This station opens at 9 am, when they are heard at good level.
WGEA—6190kc. 48.47m. Same location. Operates at from 9.30 pm. Sometimes heard at about 11 pm.
WGEO—11,847kc. 25.41m. Same location. Is on the air every night from 8.45 pm in service to Europe.
WGEO—9650kc. 31.08m. Same location. This vice to troops in the South Pacific from 8 pm till 11 pm.
WGEO—9530kc. 31.48m. Same location. This transmitter is heard from 9 am till 10 am.
WNBI—17,784kc. 16.87m. New York. A fair signal at 10.15 am on a good day.
WNBI—15,150kc. 19.81m. Same location. Heard at 10 am daily. At times it reaches good strength.
WNBI—11,890kc. 25.23m. Same location. This one is heard on Monday at 6 pm.
WRCA—9670kc. 31.02m. Same location. This old frequency is still in use to good effect. Heard at 3 pm at quite good level.
WCBX—15,270kc. 19.64m. Used in the European service in the forenoon.
WCBX—11,830kc. 25.36m. Same location. Transmission in French at 11.30 pm daily. This one has been heard operating earlier.
WCDA—17,830kc. 16.80m. Same location. News in Spanish at 8 am and 10 am. At noon the news in English is heard. Heard in some locations.
WCDA—9590kc. 31.28m. Same location. News in English at 9.30 pm.
WLWO—15,250kc. 19.67m. Cincinnati, Ohio. Best signal here at 6 pm and 1 am. In some locations is heard at 10 am.
WLWO—11,710kc. 25.62m. Same location. Yet another one to listen for at 11 am.
WLWO—9590kc. 31.28m. Same location. Heard at the same time as the 25.62m. outlet.
WBOS—15,210kc. 19.72m. Heard in relay at 1 am with WRCA in news cast.
WBOS—11,870kc. 25.27m. Same location. Heard in parallel with WNBI at 9.30 am.
WRUL—11,790kc. 25.45m. Same location. News is read here at 7.30 am and at 9.30 am. Fair signal at both times.
WRUW—15,350kc. 19.54m. Same location. This one opens at 1.15 am. Excellent signal.
WRUW—11,330kc. 35.38m. Same location. A very reliable signal at 10 am.
WRUW—9700kc. 30.93m. Same location. Heard well on opening at 7.50 am.
WCB—15,580kc. 19.30m. New York. Another one heard well in the morning. Operates from 8.15 am till 9 am.
WCW—15,850kc. 18.90m. Same location. Heard at from 8 am till 9 am at good strength, is also reported at 1 am.
WDJ—7556kc. 39.70m. Same location. This station is heard at times rather well from 6.45 pm till 9 pm.
WGL—9750kc. 30.76m. Same location. Is on the air from 6.45 pm till 9 pm. Transmission is in European languages.
WJQ—10,010kc. 29.97m. Same location. Used to be a winner here, but is not so good these days. Heard from 8 pm till 12.15 pm.
WJT—8800kc. 34.09m. Same location. News is read at 10 am.
WOK—10,555kc. 28.42m. Same location. This old telephone outlet is now used in transmission at 10 am.
KGEI—15,330kc. 19.57m. San Francisco. This outlet is on the air from 10 am daily. Heard at fair strength at 2 pm in some areas.
KGEI—11,730kc. 25.558m. Same location. A good signal towards the end of transmission at from 3.15 pm till 6 pm.
KGEI—9550kc. 31.41m. Same location. This one is heard at from 7 pm till 3 am.
KGEI—7250kc. 41.38m. Same location. A good signal which is heard from 7 pm till 3 am.
KRCA—9991kc. 31.60m. Same location. This station is not reported this month.
KWID—15,290kc. 19.62m. Same location. Is scheduled for operation from noon to 6 pm. Not so good here.
KWID—9570kc. 31.35m. Same location. A very fine signal in the transmission heard from 6 pm till 9 pm.
KWID—7230kc. 41.49m. Same location. Carries on the transmission from 9.15 pm till closing at 12.30 am.
KWU—15,355kc. 19.53m. Same location. Scheduled from 7.30 am till 9 am. Best at 8 am.
KWD—10,840kc. 27.68m. Dickson. Can be heard opening at 6.30 pm. Closes at 10.30 pm.
KES2—8930kc. 33.59m. Same location. Relays KWID at good strength from 9 pm.
KES3—10,620kc. 28.25m. Same location. Also relays KWID from 6 pm till 10 pm.
KEQ—7370kc. 40.70m. Kahuku, Hawaii. This one is not reported this month, but was heard some months ago at 11 pm at good strength.
KID—8420kc. 31.06m. Hawaii. Has been heard from time to time in poin-to-point broadcasts.
KGMB—17,960kc (approx.). Honolulu, Hawaii. This station has been heard testing at from 10.30 am to 11 am on Friday.
CBKY—11,705kc. 25.63m. Montreal, Canada. Heard at very fine strength at from 10.30 pm till 12.30 am.
CFRX—6070kc. 49.42m. Toronto. This one is reported as heard at midnight. Rather weak.
CJOX—6030kc. 49.83m. Sydney, NSW. Has not been heard here, but should come in at 11.30 pm.
XEXA—6170kc. 48.62m. Mexico City, Mexico. Heard at midnight daily.
XEWW—9503kc. 31.57m. Same location. This one is heard from 3 pm till closing at 5 pm.
XEQQ—9680kc. 30.99m. Same location. Also heard from 3 pm till 5 pm.

The following readers have reported stations in the above group:—Messrs. Harvey, Larson, Shell, Latham, Bate, Morris, Perkins, Nolan, Grigg, Williams, Fisher, Walker, Cushen, Johnson, Gaden, Smart, McKinnon, Walker (NZ), Nicholson, Lee, Condon.

CENTRAL AMERICA AND WEST INDIES

HP5A—11,700kc. 25.64m. Panama City. Still heard at midnight but is also on the air at 9 am.
HP5G—11,780kc. 25.47m. Same location. This one is reported from the parts of the country where Saigon is not heard.
HP5J—9607kc. 31.23m. Same location. Another one for 11 pm.
HH3W—10,130kc. 29.62m. Port au Prince, Haiti, French and Spanish from here at 7 am. Sometimes heard at fair strength.
HI2G—9295kc 32.28m. Cuidad Trujillo, Dominican Republic. Has not been reported this month. Listen for them at 8.15 am.
TIEP—6692kc. 44.81m. San Jose, Costa Rica. A good one some nights at 10.45 pm.
TIPMC—11,900kc. 25.21m. Same location. Operates from 11 pm till midnight.
TIPG—9520kc. 31.19m. Same location. A fine signal at 11 pm nightly.
TILS—6155kc. 48.66m. Same location. Heard at 4 pm on Sunday afternoon.
TI4NRH—9740kc. 30.80m. Heredia, Costa Rica. Strangely, this one is not reported but has been heard here at 3 pm till 4 pm on some Sundays.
TGWA—9685kc. 30.98m. Guatemala City. Look for them on Sunday at from 3 pm till 5 pm.
TGWA—15,170kc. 19.78m. Same location. Heard only on Monday at 8.30 am.
YNRS—8585kc. 34.95m. Managua, Nicaragua. Fair at 11 pm.
COBC—9695kc. 30.94m. Havana, Cuba. On the air at 9 am and 4 pm. The latter time offers the best signal.
COBC—9365kc. 32.05m. Same location. Good signal at some locations at 9 am.
COCH—9435kc. 31.80m. Same location. Heard well at 10.45 pm nightly.
COCM—9830kc. 30.51m. Same location. Good at 11 pm.
COCO—8700kc. 34.48m. Same location. Uses English at 11 pm. Fair signal.
COCQ—6375kc. 47.06m. Same location. This one varies but before long will be good signal at 10.40 pm.
COCQ—8850kc. 33.90m. Same location. Best time of transmission time is from 9.40 pm till 12.30 am. Also heard in afternoon at 5 pm and at 8 am
COCX—9270kc. 32.36m. Same location. "El Lava Casin." Heard at 9 am and midnight at good strength.
COCY—11,745kc 25.55m. Heard among the noise at 10.15 pm.
COK—11,620kc. 25.88m. Same location. Is on the air at 9 am and 4 pm.
COHI—6455kc. 46.48m. Santa Clara. Fair signal at 11 pm, which has faded out by midnight.

The following readers have reported stations in the above group: Messrs. Perkins, Nolan, Smart, McKinnon, Walker (NZ), Gillett, Condon.

SOUTH AMERICA

HCQRX—5970kc. 50.23m. Quito, Ecuador. Heard opening at 10.45 pm, and on Monday at 9 am.
HCJB—12,460kc. 24.08m. Same location. This is another Monday morning station heard at 9.30 am. Also on the air at 11 pm daily.
HCJB—10,000kc. 30.0m. Same location. This one may not be heard here but operates from 1 pm till 2 pm.
HCJB—4170kc. 71.94m. Same location. This one may be heard in New Zealand in parallel with the transmitter on 10,000kc.
HJCD—6160kc. 48.70m. Bogata, Colombia. Heard in NZ at 1.30 pm.
HJCF—6240kc. 48.07m. Same location. Also heard in NZ at 12.20 pm.
HJCX—6018kc. 49.85m. Same location. This one opens with good signal at 11 pm.
CB960—9600kc. 31.25m. Santiago, Chile. Look for this one at 4.15 pm. on Sunday.
CB970—9735kc. 30.82m. Valparaiso. Heard at 10.30 pm daily.
CB1170—11,700kc. 25.64m. Same location. Should be heard at 3 pm with fair signal later in the season.
CB1180—11,975kc. 25.05m. Same location. This is now being heard at 10.30 pm.
OAX1A—6290kc. 47.69m. Chicaylo, Peru. Heard at 2 pm with fine signal.
OAX4G—9340kc. 32.12m. Lima, Peru. Best time to hear them is at midnight daily.
OAX4G—6190kc. 48.47m. Same location. Operates at 3.30 pm on Sunday.
OAX5C—9540kc. 31.45m. Same location. Sunday at 4 pm is the time.
CXA8—9640kc. 31.12m. Colonia, Uruguay. At 7 am daily and on Sunday at 5 pm.
PSH—10,220kc. 29.35m. Rio de Janeiro. Weak signal on Saturday at 10 am.
PSF—14,690kc. 20.42m. Same location. Same service from this one.
PRE9—6105kc. 49.14m. Fortazela, Brazil. This one opens at 8 am.
LSX—10,357kc. 28.98m. Buenos Aires, Argentina. Saturday morning at 10 am.

RX—9662kc. 31.06m. Same location. Same time and service from here.

The following readers have reported stations in the above group: Messrs. Nolan, Gaden, Smart, McKinnon, Condon.

AUSTRALIA AND OCEANIA

LR—9580kc. 31.32m. Melbourne. National programme, 6.45 pm till 11.30 pm daily. Till only 11 pm Sunday.

LR3—11,880kc. 25.25m. National programme, noon till 6.15 pm daily, 12.50 pm till 6.15 pm Sunday.

LR8—11,760kc. 25.51m. National programme, 6.30 am till 10.15 am daily, and from 6.45 am till 12.45 pm Sunday.

LG2—9540kc. 31.45m. To Eastern USA, 10.25 pm till 11.30 pm, and 2 am till 2.45 am to SE Asia. To Western USA at 12.15 am to 12.55 am.

LG3—11,710kc. 25.62m. To Tahiti at 4.55 till 5.40 pm, 1.25 pm till 2.10 pm, and 3.25 pm till 4.10 pm to Western USA. To Britain from 5.55 pm till 6.25 pm, 6.30 pm till 6.45 pm, in Japanese to New Guinea.

LG6—15,230kc. 19.69m. At 8.30 pm till 9 pm to SW Pacific, and a service to Northern Australia at from 12 noon.

LG7—15,160kc. 19.79m. National programme. This one is still on the same schedule as formerly.

LG8—17,800kc. 16.85m. Is in service to Western USA at from 2 pm till 2.45 pm.

LG9—11,900kc. 25.21m. Transmission to USA at from 2 pm till 2.40 pm.

LQ2—11,870kc. 25.27m. Sydney. To NE Asia from 8.40 pm till 9.15 pm.

LQ4—7220kc. 41.55m. To New Caledonia and Pacific area at from 6.25 pm till 7.25 pm in French.

LQ6—9680kc. 30.99m. To Western USA at from 12.25 pm till 1.10 pm, and 2.25 pm till 3.10 pm.

LN3—18,495kc. 16.22m. Sydney. To USA at from 2 pm till 2.40 pm.

LN8—10,257kc. 28.50m. Not on the air at present.

LW—9680kc. 30.99m. Perth, National programme, 9 pm till 11.15 pm.

LW2—9665kc. 31.04m. To SE Asia from 11.15 pm till 12.55 am.

LW3—11,830kc. 25.36m. National programme 8 am till 11.45 am.

LW6—9680kc. 30.99m. To SE Asia from 11.15 pm till 12.55 am.

FK8AA—6130kc. 48.94m. Noumea, New Caledonia. Heard daily from 5.30 pm till 6.30 pm, and until 8 pm several nights weekly in transmission for the Pacific Area.

The following readers have reported stations in the above group:—Messrs. Harvey, Larson, Latham, Bate, Perkins, Nolan, Grigg, Cushen, Smart, McKinnon, Walker (NZ), Hanson, Lee, Morris, Condon.

AFRICA

ZTY—6002kc. 49.98m. Accra, Gold Coast. This one should prove of interest soon. Schedule 7 am till 9 am. Best time 6 am.

ZUK—6097kc. 49.20m. Capetown, S. Africa. Heard closing at 7.45 am.

ZTH—6007kc. 49.95m. Johannesburg. Also closes at the same time.

ZTB—5900kc. 50.85m. Mafeking. Heard in the same relay closing at the same time.

ZTO—9755kc. 39.75m. Durban. This one has not been reported, but is likely to be heard in the west.

?—5962kc. 50.32m. This mystery is again heard closing at 7.45 am. Who's going to be the first to identify this one?

SUX—7865kc. 38.15m. Cairo, Egypt. Transmission at 7 am in Arabic.

SUP2—6320kc. 47.47m. Same location. A very good one at from 3.30 am till 4.30 pm.

Radio Cairo—5980kc. 50.17m. Same location. Fair signal at 7 am.

Radio Addis Ababa—9620kc. 31.18m. Abyssinia. Heard at 2 am till 4 am. Closes with English announcement.

Radio Tananarive—6162kc. 48.68m. Madagascar. Has been heard from 1.30 am till 3 am. Announcements in French.

ZT7AA—6300kc. 49.71m. Luanda Angola. Port. West Africa. 8 am and 6 pm till midnight.

ZT7AB—3490kc. 86.92m. Same location. Heard at the same times. Here is one for the N. Zedders.

ZT7BD—1525kc. 19.66m. Same location. Same times of transmission.

ZT7BE—9840kc. 30.49m. Same location. Heard at 6.30 am till 7.30 am.

ZD6RA—9470kc. 31.68m. Same location. Heard on the same schedule.

FI—11,970kc. 25.06m. Brazzaville, French Equatorial Africa. A good signal at 6 am and 4.30 pm. News in English at both times.

Radio Cameroun—8000kc. 37.50m. Doula. News in French is heard at from 3.15 am till 3.30 am.

OPM—10,140kc. 29.59m. Leopoldville, Belgian Congo. Another for the early morning. Heard at 7 am.

VQ7LO—6060kc. 49.50m. Nairobi, Kenya. This one is heard from 3.30 am till 5.45 am at fair strength.

Nairobi—10,730kc. 27.96m. Same location. This is transmitting the same programme as BQ7LO, but we are still waiting to receive reports.

TFZ—12,120kc. 24.75m. Algiers, Algeria. Heard at very good strength at 6.45 pm. Is also on the air at 9 am. English is being used occasionally from here.

TPZ2—8960kc. 33.48m. Same location. Heard on the same schedule as their sister station, but is not as strong.

CNR—8035kc. 37.34m. Rabat, Morocco. Another one which may prove interesting soon. Heard at 7 am.

FGA—9410kc. 31.88m. Dakar, Senegal. According to the recent news should be worth hearing. Is on the air at 6.15 am.

The following readers have reported stations in the above group: Messrs. Perkins, Nolan, Walker, Smart, McKinnon, Gillett, Condon.

MISCELLANEOUS

OIX1—6120kc. 49.02m. Lahti, Finland. Has not been reported this month. Used to be on at 8 am.

OIX2—9500kc. 31.58m. Same location. Scheduled from 2 am till 10 am. News is heard at good strength at 3.45 am.

OIX3—11,870kc. 25.47m. Same location. Same hours as OIX2, and also at from 11.20 am till 5.45 pm. Listen to news at 2.10 pm.

HAT4—9119kc. 32.90m. Budapest, Hungary. Reported as heard at 10.10 am.

HER3—6165kc. 48.66m. Schwarzenberg, Switzerland. Heard using French and German from 4 am till 8.5 am. Good signal.

HER2—11,865kc. 25.28m. Berne, Radio Suisse. Still on the same schedule. Also heard in French and German at from 11 pm till 11.30 pm.

HVJ—5969kc. 50.26m. Vatican City. Service to Britain at from 5 am till 6.30 am.

HVJ—6005kc. 49.96m. Same location. Also heard at 6 am.

HVJ—11,740kc. 25.55m. Same location. A very good signal at 6 pm in POW service.

HVJ—15,120kc. 19.84m. Same location. Heard once a week at from 2 am till 2.30 am on Wednesday only.

CSW6—11,040kc. 27.17m. Lisbon, Portugal. Quite good in transmission from 4 am till 9 am.

CSW7—9740kc. 30.80m. Same location. Is on the air from 9.15 am till 10 am.

Emissora Nacional—7305kc. 41.07m. Ponta Delaga, Azores. A station which is often heard well from 7 am till 8 am.

Radio Caledonia—7010kc. 42.81m. This one is heard in English at 7.45 am.

Radio Metropole—9475kc. 31.66m. Heard at very fine strength at 7.10 am. Female announcer for this one.

Radio Metropole—11,740kc. 25.26m. This one uses an assortment of foreign languages in transmission at 2.15 am.

Radio Metropole—15,245kc. 19.69m. Heard at colossal strength at 7 am.

Europe Revolutionary—9640kc. 31.12m. Anti-Nazi talk in German at 5 am and 7.30 am.

Radio Debunk—10,340kc. 20.01m. Has been reported from New Zealand as heard at 11.30 am till 12.30 pm.

TAP—9465kc. 31.70m. Ankara, Turkey. Transmits from 1.15 am till 7 am. Good when news is read at 5.15 am.

TAO—15,105kc. 10.74m. Same location. A fair signal here at 11.30 pm.

Radio Bucharesti—9255kc. 32.41m. Rumania. Some fine orchestral music may be heard from this one at from 3 am till 9 am. News at 7.50 am.

YUB—6100kc. 49.18m. Belgrade, Yugoslavia. On the air from 5 am till 9 am.

SBU—9530kc. 31.46m. Motala, Sweden. Good signal from 8.15 am till 9 am.

SBP—11,705kc. 25.63m. Same location. Scheduled at 4.56 am till 5.15 am, 6.56 am till 8.30 am, and 5.40 pm till 6.30 pm. The latter transmission is heard best now.

SBT—15,155kc. 19.80m. Same location. Easily found at 2 am till 3 am.

LKQ—11,735kc. 25.57m. Oslo, Norway. This one was heard some weeks ago at 4 pm.

PCJ—9590kc. 31.28m. Huizen, Holland. Has not been heard this month.

Paris—6200kc. 48.39m. France. Now being heard at very fine strength at 6 am.

Vichy—9510kc. 31.55m. France. Heard very well at 6 pm daily.

Vichy—9520kc. 31.50m. Same location. Heard at some locations at 2.15 pm.

Vichy—11,855kc. 25.53m. Same location. Is on the air from 4 am till 9.50 am.

Vichy—15,245kc. 19.69m. Same location. From 12.30 am till 3.45 am. Good signal at most times.

Kuibeshev—6115kc. 49.08m. Has been heard in contact with NBC and CBS at 11 pm.

Moscow—7625kc. 39.21m. Can be heard at 7 am and at 10 pm.

Kuibeshev—8047kc. 37.28m. News in English by lady announcer at 6.30 am. Also heard at 9.30 pm.

Kuibeshev—9520kc. 31.51m. Also heard calling NBC and CBS at 11 pm.

Khabarovsk—9566kc. 31.36m. Heard from 8.45 pm onwards on good nights.

Moscow—10,040kc. 29.88m. News and talks in English at 12.30 am.

Moscow—11,860kc. 26.41m. News at 3 pm in Spanish after opening at 2.30 in French.

Moscow—11,950kc. 25.10m. Very good signal at 5 pm.

Moscow—12,060kc. 24.88m. English used here at 11.45 pm.

Moscow—15,230kc. 19.70m. Is to be heard in certain locations at from 10 am till 11 am.

2RO3—9630kc. 31.15m. Rome, Italy. Heard afternoon, evening, and night.

2RO4—11,810kc. 25.40m. Same location. Good signal at 1.30 am, 6 pm, and 7.15 pm. English at all times.

2RO6—15,300kc. 19.61m. Also heard at the same times.

2RO8—17,820kc. 16.84m. Same location. This outlet is heard at 9 pm.

2RO9—9670kc. 31.02m. Same location. Has not been heard over the last few weeks.

2RO11—7220kc. 41.55m. Same location. Is on the air from 3.30 am till 9.15 am. Best signal at 7.30 am.

2RO17—19,590kc. 15.31m. Same location. This one is now heard under the Morse at 10 pm.

2RO18—9760kc. 30.74m. Same location. A fair one at 10 am.

2RO20—17,820kc. 16.87m. Same location. Should be heard in good locations if still in service. About 9 pm possibly.

2RO?—6300kc. 47.60m. Same location. Heard from 3.30 am till 9.15 am. The volume from this one is excellent.

2RO?—10,330kc. 29.04m. Same location. A very good one at 8 am.

2RO?—9695kc. 30.63m. Same location. Carries a service to Latin America commencing at 9.30 am.

2RO?—11,740kc. 25.55m. Same location. Also on the air from 3.30 am till 7 am.

2RO?—11,950kc. 25.10m. Same location. Heard well in the early morning.

2RO?—15,060kc. 19.92m. Same location. Heard very well at 11 pm.

DJA—9560kc. 31.38m. Berlin, Germany. Is on schedule at from 8.50 am till 3.15 pm.

DJB—15,200kc. 19.74m. Same location. Also in the same relay. Good signal.

DJC—6020kc. 49.83m. Same location. Quite good at intervals between 4.30 am and 8.25 am. Good in POW at 6.25 am.

DJD—11,770kc. 25.49m. Same location. In same relay as DJA.

DJE—17,700kc. 16.89m. Same location. An excellent signal from 9 pm till 3 am. Also heard at 6 pm.

DJH—17,840kc. 16.81m. Same location. Not quite as good as DJE, but is not heard at 6 pm.

DJL—15,100kc. 19.85m. Same location. Heard from 2.40 am till 8.25 am. Also at 9 pm.

DJP—11,855kc. 25.31m. Same location. In relay at 8.50 am for Latin America. Is excellent at midnight in transmission opening at 7.15 pm till 3 am.

DJQ—15,220kc. 19.63m. Same location. Is very good at 9 pm till 3 am.

DJR—15,340kc. 19.56m. Same location. Opens at 4 pm, with news at 6 pm and 11 pm, closes at 3 am.

DJW—9650kc. 31.09m. Same location. Heard in transmission at 8.50 am till 3.15 pm. Also on the air from 4 pm till 3 am. Good at 5 pm.

DJX—8670kc. 31.01m. A good signal in parallel with DJL.

DXJ—7240kc. 41.44m. Same location. Heard from 3.30 am till 8.45 am and from 2 pm till 4.35 pm. Excellent signal at 6.40 am.

DXM—7270kc. 41.27m. News is read from this one at 3.30 am, 4.30 am, 6 am and at 7.45 am.

DXP—6030kc. 49.73m. Same location. A good signal at 7 am.

DXR—11,760kc. 25.51m. On the air from 3.15 am till 8.25 am, and 4 pm till 6.15 pm.

DXX—6140kc. 48.86m. Same location. At 6.30 am the news is read in English.

DXZ—9570kc. 31.35m. Same location. In parallel with DXJ from 3.30 am till 8.45 am.

DXL7—11,855m. 25.30m. Same location. Has not been heard this month.

DXL24—9620kc. 31.18m. Same location. Opens at 8.50 am and is heard in Australian POW news at 4.30 pm.

DZA—10,087kc. 29.75m. Same location. Good signal at 6.30 am.

DZB—10,040kc. 29.86m. Same location. Also very good at 6.30 am.

DZC—10,290kc. 29.15m. Same location. Heard well at 8.50 am on opening, and from 7 am till 7.45 am.

DZD—10,530kc. 28.45m. Same location. This one is heard at excellent level at 9 am. Remains on the air till 8.45 am.

DZE—12,130kc. 24.73m. Same location. Service for Latin America at 8.50 am till 3.15 pm.

DZH—14,460kc. 20.75m. Same location. Said to be on at 9 pm.

DXC2—11,740kc. 25.55m. Same location. Is not heard at present.

DHE2A—6010kc. 49.92m. Prague. Sometimes heard at 7.30 am.

DHE4A—11,840kc. 25.34m. Same location. The same remarks apply to this one.

The following readers have reported stations in the above group:—Messrs. Larson, Sheil, Latham, Perkins, Nolan, Swingle, Walker, Cushen, Johnson, Gaden, Smart, McKinnon, Walker (NZ), Sheil, Wass, Lee, Morris, Gillett, Cluck.

THIS MONTH'S RECORDINGS

Audio amplifiers have always occupied a prominent place in the technical pages of "Radio and Hobbies." Now that the manufacture of new amplifiers has been curtailed by the parts position and by regulation it seems only logical to give over a little of the space hitherto devoted to apparatus to a review of the latest recordings.

THE section should be most helpful to the many enthusiasts, who, by reason of long hours of work, have not the opportunity to consult catalogues or to listen to latest releases at the larger record houses.

"ALSO SPRACH ZARATHUSTRA"

We make our debut in these columns with a review of a magnificent recording of "ALSO SPRACH ZARATHUSTRA" ("Thus Spake Zarathustra"), a composition of RICHARD STRAUSS and played by the BOSTON SYMPHONY OCHESTRA, under the baton of SERGE KOUSSEVITSKY. HMV ED152/6; Album No. A21 with explanatory leaflet.

Richard Strauss is not as well known to the general public as is his brother Johann, of waltz fame. Actually, there is no comparison between the two men, for there is little of the "popular" style about the music of Richard Strauss.

"Also Sprach Zarathustra" was composed in 1896, ten years after Nietzsche, the German philosopher, who is "credited" with inspiring the actions of Hitler, wrote his philosophical work under the same name.

In the score of the composition, Strauss added quotations from Nietzsche's book, which provide some idea of what the music is about. However, Strauss stated that his tone poem was not intended to put Nietzsche's book into musical form.

Nevertheless I am an advocate of attempting to form mental pictures applicable to music as an aid to the better enjoyment of it and as an aid to concentration, which is surely difficult enough in these hectic days. If it is possible to obtain Nietzsche's work and glance through the subject matter (it is pretty solid reading to make a study of it), I would advise anyone to do so.

Those who can read music may obtain the musical score of the work and follow the orchestral rendering. Both Nietzsche's book and the musical score of Strauss' work can be obtained from the Sydney Municipal Library.

I offer these suggestions for what they are worth, knowing full well that some will disagree with me and will prefer simply to listen to the music, forgetting all about mental pictures and the like. However, whichever way one looks at it, one cannot avoid getting a real thrill from this recording.

FIVE RECORDS

There are five records, with the whole work divided into eight sections, as follows: (1) "Of the inhabitants of the unseen world," (2) "Of the great longing," (3) Of joys and passions," (4) "The Grave Song," (5) "Of Science," (6) "The Convalescent," (7) "The Song of the Dance," (8) "The Song of the Night Wanderer."

Typical of Richard Strauss, the composition opens with awe-inspiring magnificence. Zarathustra apostrophises the sun at dawn. "Thou tremendous planet, what would be thy happiness if thou had not those to whom thou givest light?"

In slow time, for four bars, the double bassoons, organ, double bass tremolo and a long drum-roll hold a low C pedal point. Then four trumpets slowly play C, G, C octave, followed immediately with two brilliant chords, in the second of which the tympani thunder out, tonic and dominant This is repeated three times but, at the third repetition, it is considerably extended and the second C major chord is reinforced with the full organ.

Mastery of orchestral effects in characteristics of Richard Strauss and is amply displayed in this work.

The first section takes up about half one side; the rest of the side requires very careful listening for the pianissimo is sometimes barely audible above the surface noise of the record.

However, the muted basses and celli, interspersed with pizzicato effects and organ, are weird and inspiring. This is the "Of the inhabitants of the unseen world" section and leads to side two.

To really appreciate side one, with its deep bass and its pianissimo passages, something pretty good in the way of amplifying equipment is required, with power enough to do justice to the dynamic range of the record. Unless the bass response is good, the introductory passages are liable to become little more than a meaningless jumble of higher order harmonics.

The beginning of side two introduces us to a flowing melody which is easily associated with those, who in the unseen world, seek "a better other truer faith."

Here the composer leads up to "The Great Longing," which in interspersed with passages from cor anglais, organ, oboes, and horns, and side two sweeps on to a tremendous fortissimo climax, ending with an upward rush of the woodwind and a glissando on the harp.

In this composition, Strauss writes a fugue and a waltz tune. In fact, Strauss came in for quite a lot of criticism regarding the form af "Also Sprach Zarathustra." This does not much concern us if we appreciate this kind of music, regardless of form and whether the composer should have done this or that.

The first disc particularly, I venture to say, will be extremely popular, and, for those who take pride in their pick-up amplifier, it would be difficult to find a recording better suited to show its capabilities.

★ ★ ★

"WARSAW CONCERTO"

"WARSAW CONCERTO," Columbia DOX 689. Recorded from the sound track of the film, "SUICIDE SQUADRON."

When this film was screened in England, there was a phenomenal demand for this record of "Warsaw Concerto," which was performed in the film. You may have heard it.

For those who have not, I will say that this recording is colossal. It is not a concerto in the sense that we associate with Tschaikovsky or Brahms, but it is a really audacious piece of work.

We do not know much about the piece except that it was composed by Richard Addinsell, an English composer. Neither the orchestra nor the name of the pianist is stated. Whoever the pianist is is no amateur, for the performance of this work requires considerable dexterity, and it is a pity his name is not given.

by Audisc

The record opens with a few thunderous bars on the piano aided by crashes on the tympani. This is followed by orchestral passages and various piano parts which go to make up a rather melodious whole.

As for the composition itself, it is quite evident that it was composed mainly for popular tastes and savors both of Rachmaninoff and Liszt, combined with the melody of Ketelby.

The second side of the record opens with a tune that, to me, has a distinctly Ketelby touch and this tune is played upon both by piano and orchestra in rather a clever fashion.

On the whole, the composition is pleasing, being of a spectacular nature; it is played forte throughout with the exception of thos bars which lead up to the main stretches o full piano and orchestra combination.

The orchestra is full but, as the disc i rerecorded from the sound track of a film there are certain imperfections in quality These are apparent as a lack of real brilliance in the upper register of the violins and certain fuzziness here and there. This ma pass more or less unnoticed with an ordinar reproducing system, but will be apparent o any having a wider frequency range.

Nevertheless, when this record is release (it will be released before this issue is o sale), it should prove very popular. Despit the imperfections mentioned, the record is pretty good test as to the ability of the repro ducing system to handle heavy piano passages

★ ★ ★

"BEATRICE AND BENEDICT" OVERTURE

"BEATRICE AND BENEDICT" Overture (Ber lioz), LONDON PHILHARMONIC ORCHESTRA conductor, SIR HAMILTON HARTY. Columbi LOX518.

Berlioz was a master of orchestration. He i reputed to have known the capacity of th different instruments of the orchestra bette than the players themselves. At all events his work has been a guide to every compose since his day and he was, in addition to bein a composer of merit, a prolific writer of tex books on orchestration.

Berlioz was one of a number of composer who since Beethoven broke away from th "absolute" music idea and wrote to a pro gramme. He gave to the orchestra a new meaning, in that he employed instrumenta timbre as a means of expression. In othe words, his music was descriptive.

It is reported that the King of Prussia onc said to Berlioz, "I understand that you some times compose for 500 instruments." "Yo are mistaken, Sire," said Berlioz, "I some times write for 450."

Berlioz was a great believer in the larges combination of instruments he could find. don't know whether his ideas in this regar were ever tried out, but it would be mar vellously interesting to listen to a combinatio of 450 instruments.

"Beatrice and Benedict" is a charming oper written around Shakespeare's "Much Ado Abou Nothing." It has a charming melody, whic is vivid and light-hearted.

The overture has three contrasted themes interrupted here and there with an excerp from the opra, the aria in which Beatrice find herself in love.

The opera itself is worthy of more frequen performance, as it is very tuneful and ca be understood after hearing the overture.

Like most English recordings, this one i brilliant, with clear definition of the variou instruments of the orchestra. Musically th recording is excellent. Technically it is th same and will do justice to any good recor player.

★ ★ ★

"LEMMINKAINEN'S HOMEWARD JOURNEY"

"LEMMINKAINEN'S HOMEWARD JOUR NEY," played by the PHILADELPHIA OR CHESTRA, conducted by EUGENE ORMANDY HMV ED157.

Sibelius always recommends himself, in tha his music is so national in character as to b almost self explanatory. One needs only t be given the title to his compositions to kno what the music is about.

The works of Sibelius are chock full o natural subjects, swans, roses, romances, &c Then there are his legends, of which th "Swan of Tuonela" is one, together with th companion piece, "Lemminkainen's Homewar Journey."

The national character of Sibelius' music in which he seems to depict phases of lif of the Finnish people, is shown in his Karelia Suite and in "Finlandia." This last is wel known, as is also his "Valse Triste."

"Lemminkainen" is not nearly so well known as it deserves to be. It is gratifying to hav this record released and to find that such combination as the Philadelphia Orchestra ha been chosen for the rendering. That in itsel is sufficient for most people.

The music is intriguing. Beginning in easy "onward" style (if I may be excused fo coining a word that I think is applicable t this kind of music), it jogs along in a manne suggesting expectant homecoming, with occa sional bursts of beautiful chords inserted jus where they are not expected.

One is thus continually kept on the aler right to the end of the piece. It is the kind of music that goes well with "Also Sprach Zarathustra."

OTHER RECORDS

FRITZ KREISLER on the violin plays "TANGO" (Albeniz) and "MALAGUENA" (Albeniz). HMV EC84.

This famous violinist treats us to more of his own arrangements of well-known piano solos. Both numbers are well played, as can be expected, and the recordings are good. The items are known well enough to need no comment; and if you like them you will also like this record.

* * *

LILY PONS, "ECHO SONG" (Bishop). HMV EC95.

Yet another disc of Lily Pons, whose popularity has not waned since her film days. This composition by Bishop is just the kind of music to bring out the flexibility of a good coloratura. What I like most about Lily Pons is the fact that she can sing in tune—a gift which even the most famous sopranos do not always possess.

There is the usual flute obbligato to add zest to the rendition and, taking it all round, the performance is very effective.

* * *

MARIAN ANDERSON, contralto, "TRAMPING" and "I KNOW DE LORD'S LAID HIS HANDS ON ME." HMV EC96.

Lovers of negro spirituals will like this record. Marian Anderson has got herself into the news lately by her refusal to sing in concert halls in America which carry out the practice of separating the negroes from the whites in the audience.

Being a member of the negro race herself, and being gifted with such an extraordinary voice, she doubtless feels she has a great mission to carry out on behalf of her race.

It is seldom that one hears negro spirituals sung with such feeling and depth of tone. The range of Marian Anderson's voice is remarkable and in the lower register the tone borders on the masculine. I enjoyed this record immensely.

* * *

RICHARD CROOKS (tenor) "ALMA MIA" (Handel) and Air from "COMUS" Serenade (Haydn). HMV EC97.

There are some who like Crooks when he sings lyrics and some who prefer his operatic renditions. To my mind, Crooks is best as a singer of lyrics. There is no doubt of his ability in this regard. In this record, he has his usual appeal in lyric style and gives us a fine interpretation of these numbers.

* * *

THE KENTUCKY MINSTRELS, The "PROMISE of LIFE" (Cowen); with organ accompaniment. HMV EA2960.

Whenever I hear the Kentucky Minstrels I always get that tingling feeling in the spine which is supposed to indicate that I am on the verge of joyful tears. No combination of male voices gives me such pleasure to listen to.

In this number, which covers both sides of a 10in. disc, the Kentucky Minstrels sing beautiful and melodious harmony which must appeal to all music lovers. I strongly advise that record be heard.

POPULAR NUMBERS

Popular numbers released in January are:—

Columbia.—VICTOR SILVESTER and his Ballroom Orchestra: "How Do I Know It's Real" and "Forever and a Day," DO2501. "This Love of Mine" and "Someone's Rocking My Dream Boat," DO2504. KATE SMITH with Orchestra: "Along About Sundown" and "You Can't Brush Me Off," DO2503.

His Master's Voice.—DUKE ELLINGTON and His Orchestra: "Dusk" and "Blue Goose," EA-2967.

Decca.—The ever-popular FLANAGAN AND ALLEN in "Down Forget-me-not Lane" and "Rose O'Day," Y5743. BING CROSBY: "The Anniversary Waltz" and "Darling, Je vous time beaucoup," Y5744. Also Bing in "The Whistler's Mother-in-law" and "Day Dreaming," Y5746. The ANDREWS SISTERS sing "The Nickel Serenade" and "The Booglie Wooglie Piggy," Y5745; also "Why Don't We Do This More Often" and "Jealous," Y5747. VERA LYNN tears at the heart-strings in "When You Come Home Again" and "You're in My Arms (a Million Miles Away)," X2077. JUDY GARLAND asks "How About You" and "Blues in the Night," X2078.

RECORDS TO BE RELEASED IN FEBRUARY:

Columbia.—VICTOR SYLVESTER and His Orchestra: "Tomorrow's Sunrise" and "Anniversary Waltz," DO2506.

Decca.—FLANAGAN AND ALLEN: "I Don't Want to Walk Without You" and "Miss You," Y5748. VERA LYNN: "Someone's Rocking My Dream Boat" and "One More Kiss," X2079.

HINTS FOR THE RADIO HOMEBUILDER

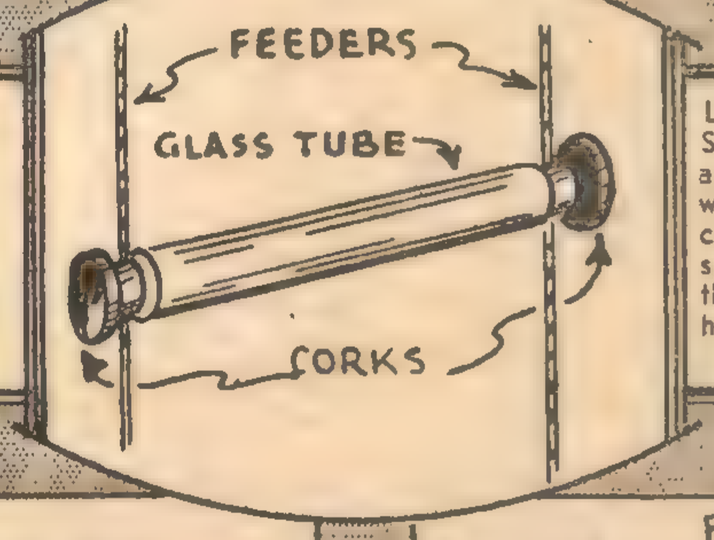
BY W. G. NICHOLLS

SPRING CLEANING CABINETS

Metal cabinets used for laboratory instruments, which have been finished in black crackle paint, become soiled with dust, but can be rejuvenated by coating with black boot polish and rubbing with a soft cloth.

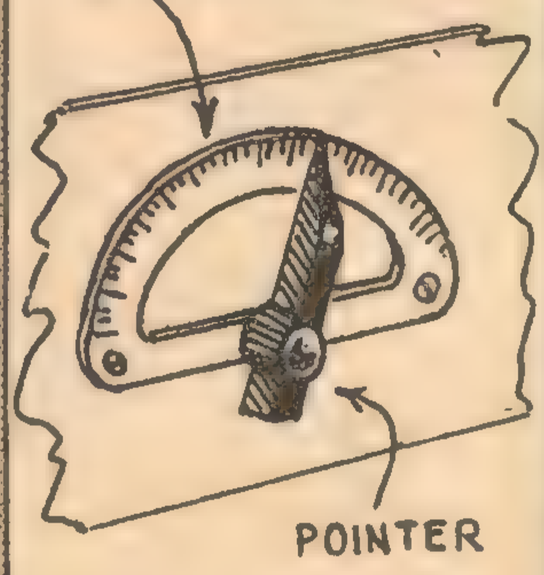
DUSTPROOF MIDGET CONDENSER

Midget condensers may be affected by dust particles, but can be protected by mounting them in an old potentiometer case and then glueing a circular piece of celluloid over the back. The plates of the condenser are connected internally to the lugs of the potentiometer.



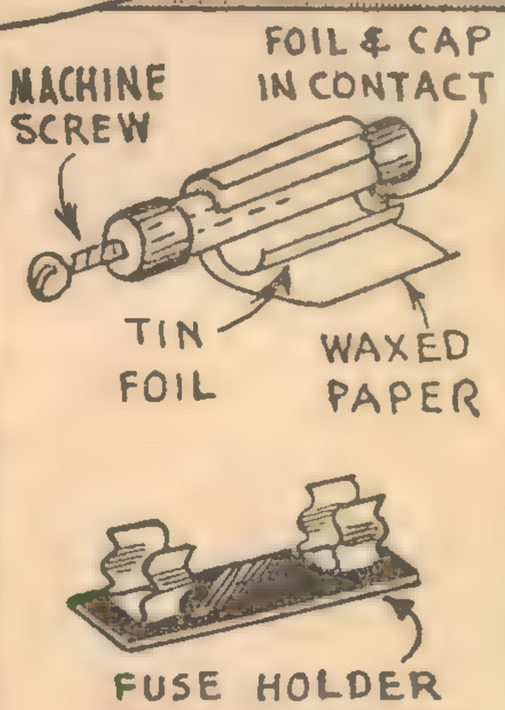
LOW COST SPREADERS

Spreaders for doublet aerials are easily made with 4in. lengths of porcelain or glass tube and split corks. Feeders pass through slots in corks and held firmly when the corks are pushed in.



180 DEG. DIAL SCALE

An inexpensive dial scale can be made by using cheap tin protractors, as shown. The protractors are held in position on the panel by means of two small machine screws and nuts, passing through both protractor and panel.



ANTENNA TRIMMER CONDENSERS

Small variable capacitors can be made from burnt-out motor-car fuses. A hole is tapped through one end cap of the fuse and a machine screw threaded into it. The other end cap is connected to the tin foil, the lot being covered with waxed paper.

COLOURFUL NOVELTIES FOR THE HOME

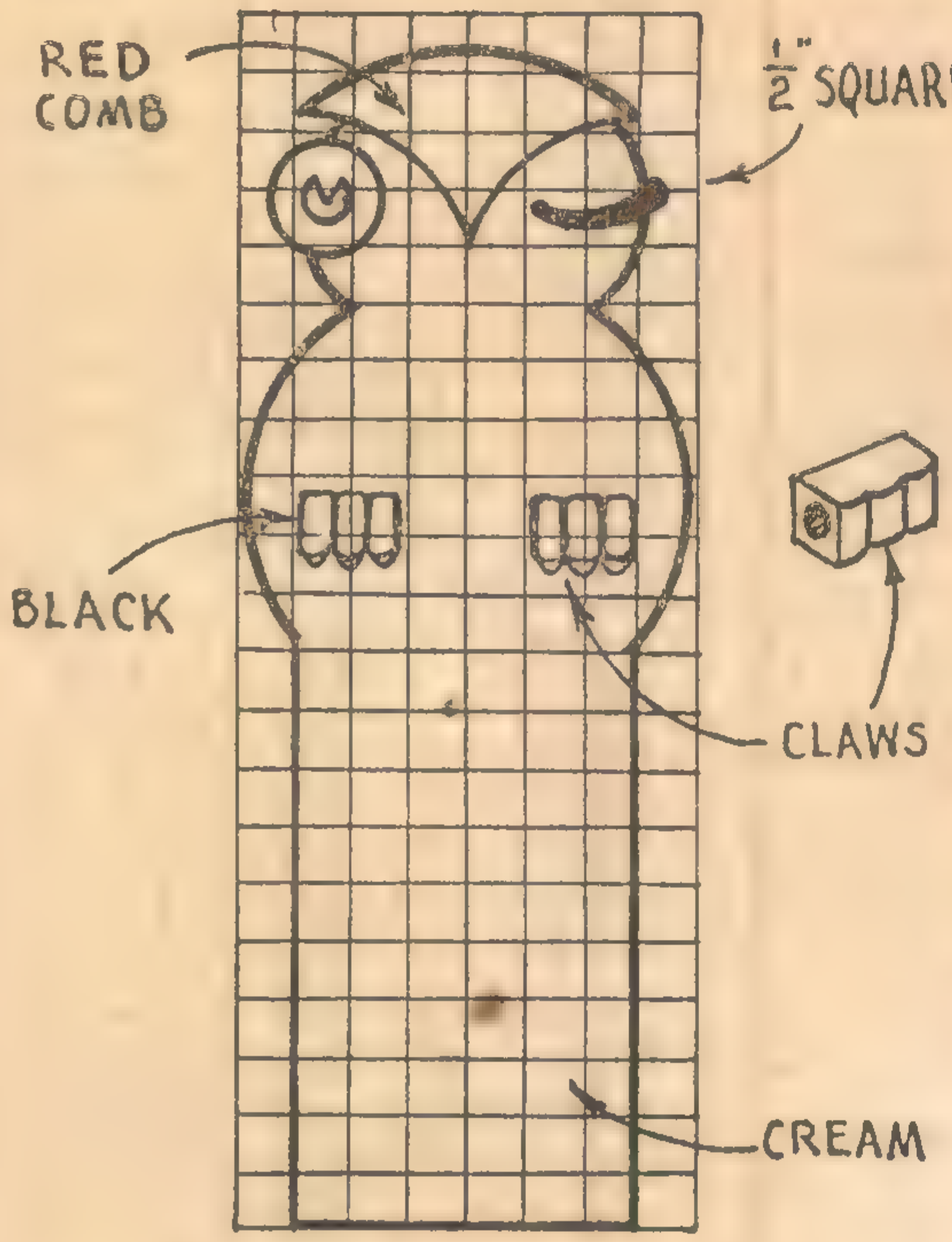


FIG. 1

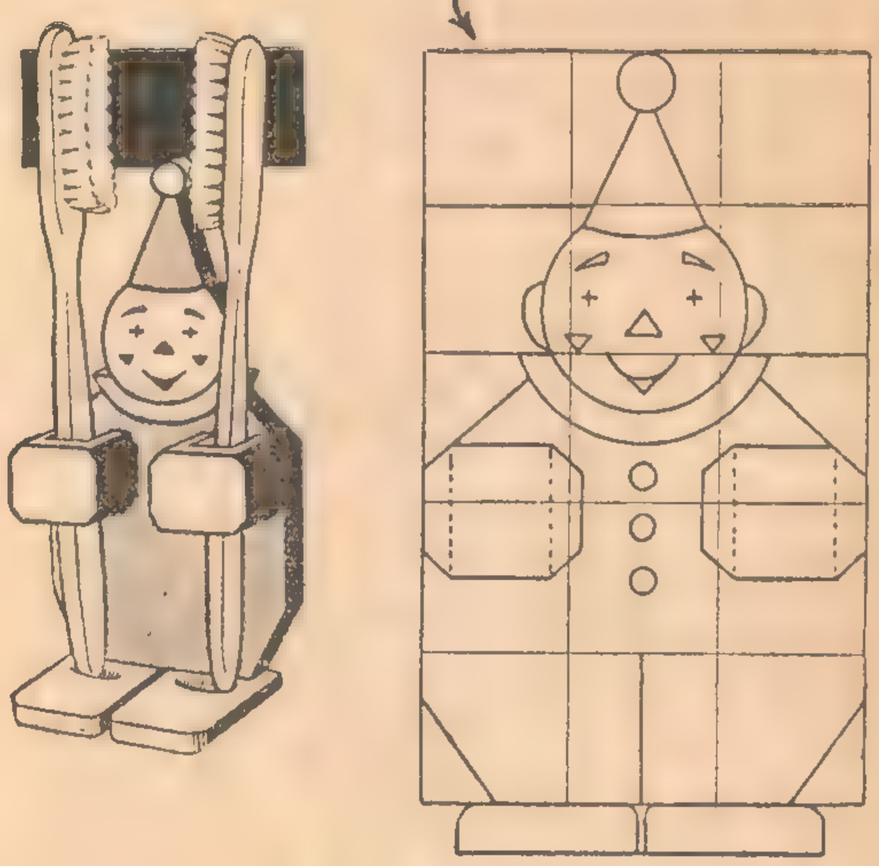


FIG. 2

The busy housewife usually tries to memorise the household requirements, with the inevitable result that important items are sometimes omitted from the shopping list. The figure of a wise old owl, hanging on the kitchen wall and holding a memo pad, is an inducement to jot down things as they come to mind. The second novelty is a toothbrush holder.

IF carefully made and finished in bright glossy colors, both these little trinklets will have a decorative as well as a practical value. They will help to make home a little more interesting and romantic for the kiddies.

The figure of the owl can well be made from ¼-inch plywood. It can be hung on a nail or screwed to the wall. As shown in the illustration, a small memo. pad is affixed to the body and an ordinary pencil is held in the claws.

First obtain a piece of ¼-inch plywood, measuring 10½ inches long and four inches wide. Mark it out in half-inch squares and, by referring to Figure 1, transfer the design to the wood.

Next obtain a small scrap of one-eighth inch or three-sixteenth inch plywood. Mark out a number of half-inch squares on the surface and cut out the lower outlines of the portion marked "red comb." The upper portion of the comb need not be cut out at this juncture.

Now paint the underside of the comb with a good glue and place it on the plywood back, so that the squares coincide and the portion of the comb pointing vertically downwards is in the exact position shown in the drawing. Set aside to dry.

by
W. G. Nichols

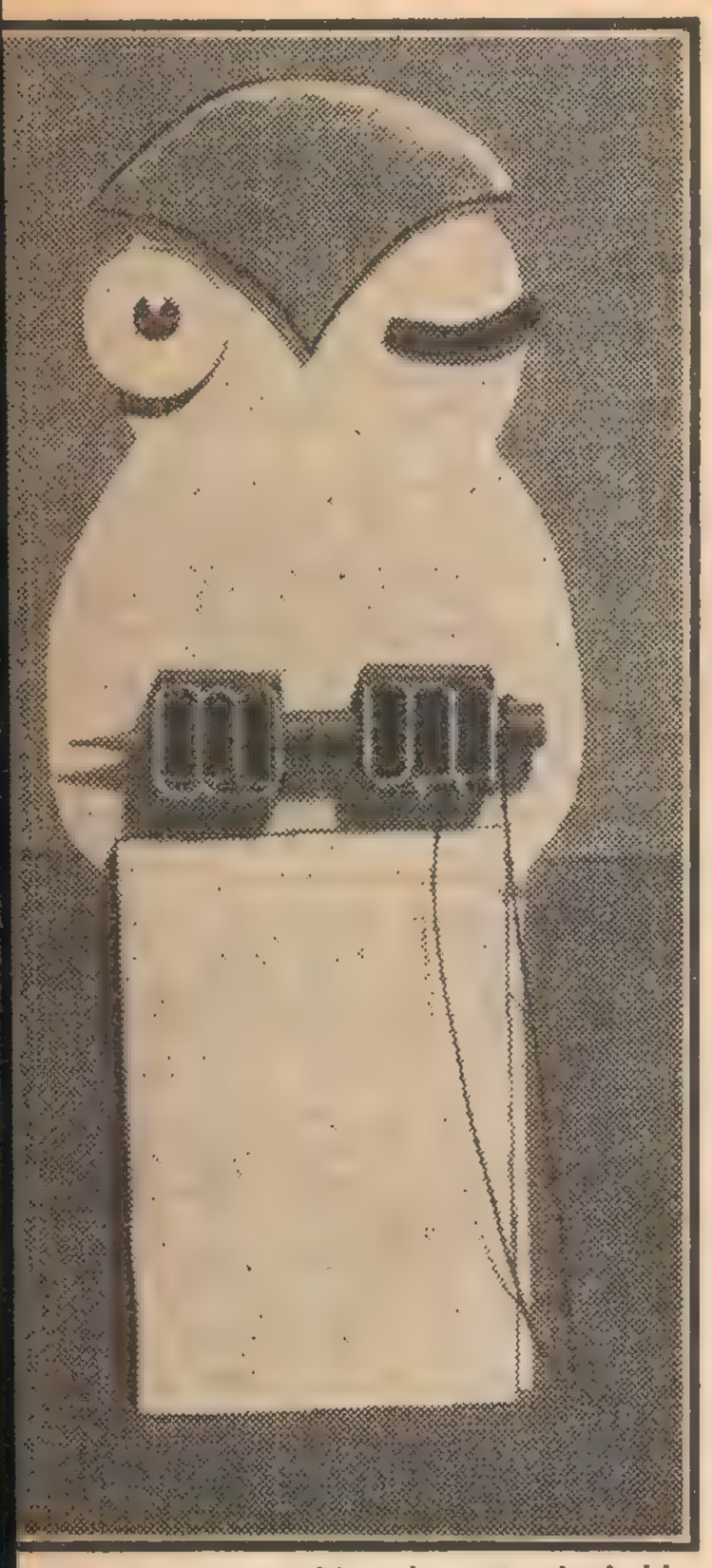
The eyes and the claws may be cut out in the same fashion from a scrap of one-eighth inch or three-sixteenth inch plywood. The open eye is a circle one inch in diameter, and the closed eye is moon-shaped, as shown. Cutting out the eyes and comb in this manner rather than simply outlining them on the flat surface, makes them stand out and gives an impression of depth.

CLAWS HOLD PENCIL

The claws are cut from two blocks of soft wood one inch long, three-quarters of an inch wide and five-eighths of an inch thick. Carve them slightly to the shape shown and drill holes longitudinally through them of diameter sufficient to take an ordinary lead pencil.

When the glue attaching the comb to the back is thoroughly dry the outline can be cut out with a fretsaw, the edges then being smoothed carefully with sandpaper.

A MEMO PAD AND TOOTHBRUSH HOLDER



Here is our wise old owl, patiently holding a pencil and memo pad. Seen in its full colors he is quite a bright looking fellow.

If you have a steady hand, the parts can be assembled and then painted in appropriate colors. Otherwise, do the painting first, glueing the parts together when the paint has dried.

The body of the owl can be finished cream. The open eye can be white, with a black pupil, and the closed eye black. Claws may be black and the comb a bright red.

SCRIBBLING PAD

The scribbling pad should be about four inches long by about three inches wide, and may be held in place by a couple of rubber bands running around the owl and over the cardboard backing of the pad.

The second novelty, "Clino the Clown," will be of interest to the children and may help to remind them of the easily-forgotten task of cleaning the teeth.

Take a piece of quarter-inch plywood, measuring five inches by three inches. Divide it into one inch squares and mark out the design, by referring to the drawing in Figure 2. Cut around the outline with a fret saw and carefully sand the edges.

From small scraps make up two brackets to the approximate dimensions shown in the sketch marked "top of hands." From another scrap make a grooved platform, as shown in the sketch marked "top of feet." The grooves must be arranged to seat the handles of the two toothbrushes. If desired, the feet may be made sufficiently long and provided with a small turn up, so as to carry a tube of toothpaste.

Sand the wood well, assemble with small brads and waterproof glue and finish in bright, glossy colors.

Remember that this novelty will be in the bathroom and may become moist on occasions. The edges of the plywood should, therefore, be well finished to prevent the entry of water with consequent swelling and warping.

WAYS AND MEANS OF MEASURING TIME

(Continued from Page 4)

of this calendar dial is shown the true solar time, the time of rising and setting of the sun and moon, and the eclipses.

There are other dials showing the year, the solar cycle, the equation of time, the day of the week, the mean time, &c.

On each side sits an angel. The first stroke of the quarter hours are struck by one angel on a little bell, and the other angel turns over an hour glass every hour.

Above this is a planetarium showing the motions of all the planets. The phases of the moon are shown, and higher up are figures representing the four ages and death. An infant strikes the first quarter with a rattle, a young man strikes the half with an arrow, a warrior strikes the three-quarters with a sword, and an old man strikes the four quarters with his crutch; death strikes the hour with a bone.

In the upper gallery, Christ is seated on a throne, and at noon the 12 Apostles pass before him and bow whilst the cock on the top of the tower crows three times.

OTHER CLOCKS

There is a famous clock in London, in Hampton Court Palace. The original clock was made in 1540, but has since worn out. A new movement was made in 1879 for the old dial.

The dial consists of three separate copper discs, which revolve and show in which quarter the moon is, with its varying shape, and when it crosses the meridian.

Another disc indicates the month, the day of the month, the sign of the Zodiac in which the sun is located, and the degree of the sign.

The 24 hours are painted on the stone work within which the disc revolves, and the outer circle is 10 feet in diameter.

There are many other clocks throughout the world of great fame and deserving of description, but I have space only for some statistics of the most famous Tower clock in the world—the Westminster Clock in the London Houses of Parliament.

It was made in 1854. The tower is 40 feet square, and the dials 23 feet in diameter. The hour hands are solid gun metal, and are 9ft. long, while the minute hands are hollow tubes 14ft. long. The frame holding the movement is 15ft. long, and 4ft. odd wide.

The pendulum is 13ft. long, beats once every two seconds and weighs 700lb. It takes 20 minutes to wind the time mechanism once a week, and several hours twice a week to wind the striking and chiming parts.

FIVE HUGE BELLS

The hour is struck on "Big Ben," on a bell which weighs 13 tons 11cwt., with a clapper weighing 7661b. There are four other bells for the Westminster or Cambridge chimes. These weight from about four tons down to one ton. The total cost of the movement, hands, dials and bells was £20,000. It is not the largest clock in the world, but the most famous.

One of the largest tower clocks in the world is in Malines, in Belgium. It is located in a tower 300 feet above ground. The dials are 44ft. in diameter. The clock was made in 1708, and has but one hand. This clock has about seen its day, and is no longer used as such. Probably Corporal Schicklegruber has removed it by now, and is using it in some way to bring in his new order. I don't suppost the thing was of Aryan origin, anyway.

R.A.A.F. May Spot Bushfires

THE possibility of Air Force assistance in spotting bushfires is being examined by the authorities.

RAAF trainee pilots particularly could be of assistance.

The danger period for bushfires will occur when the heavy growth begins to dry, and the moisture has gone from the undergrowth.

Under National Security Regulations, lighting of fires for burning-off is now prohibited from November to February.

Thus, spotting by RAAF planes would be of more practical value than formerly when many burning-off fires were mistaken for actual bushfires.

In one NSW country area a military commanding officer has offered to make 1000 men available to help local fire-fighting organisations. Their operations would cover 100 miles.

FEATURE STORY

PERFECT EYES ARE IN THE MINORITY

(Continued from Page 8)

the surface of the eyeball, with the same effect as if you had dragged a rock along the top of a mahogany table.

You can figure out for yourself the chance of infection, and a serious infection of the eye amounts to a flirting with blindness. There is a very fair chance, too, of accidentally pushing the cinder into the interior of the eye.

The modern cult of sunbathing, which put the whole world into dark glasses, has added another to the oculist's stock of worries. A man who insists on the best quality he can afford in clothes and food and drink, drops into any general store and buys a 1s pair of dark glasses to wear for the entire swimming season.

He is unaware that they are pretty certain to be full of flaws that will affect his eyes in strange and brutal ways, and when they give him a headache he blames the sun.

TOUGH ON THE EYES

They may even be roughly prismatic, like lenses for astigmatic eyes, and so as tough on his adjusting mediumism as tap dancing would be on a man with a broken leg. Normal eyes, rare but existent, deserve dark glasses made of innocuously first-class glass, bought from a reputable optician.

Abnormal eyes are bound to suffer unless their dark glasses are ground to the same prescription as the glasses which already are, according to sex, age, or temperament, either on your nose or in your pocket, or languishing at home in the lowboy drawer.

Diffused daylight is probably the best all-round indoor illumination, but daylight has its drawbacks. With all the will in the world, mankind cannot keep the sun in one place or prevent the clouds from crabbing its act—so altogether daylight is sadly unadjustable.

Some modern architects are building factories, schools, stores, and such without windows at all, on the principle that first-class artificial lighting, which can be controlled, is better for the eyes than daylight which comes and goes as it likes and will require jangling assistance from artificial light half the time.

They'd like to do it on dwelling houses, too, but few people will stand for living in a bank vault.

Glare is the villain of the piece. The unshaded electric light bulb, whether wholly exposed or with merely the tip showing beneath the shade, is pure poison. So is sunlight in the raw, either falling directly on your book or reflected from wet pavements, off shiny window sills or glass desk tops.

People who have gone temporarily snow blind, with the accompanying flashes of red light and shooting pains through the eyeballs, don't need to be told what reflected glare can accomplish.

It's not a discouraging picture on the whole, even if the human race does have so long to wait before the Cyclopean stereoscopic eye arrives! Researchers are pushing farther afield every day into the mysteries of eyesight and the contact lens and the non-shatterable lens and the optician's determination to take the curse of disfigurement off the primitive spectacle, are all evidence of healthy growth. In fact, the only sceptical device which has not seen immense improvement in the last hundred years is the glass eye.

AIRCRAFT OF TO-DAY

(Continued from Page 9)

was able to operate successfully at altitudes as great as 40,000ft., it is reported.

Now the existence of a bigger and still more powerful Spitfire is announced. It is equipped with a bigger engine and a four-bladed propeller, and is armed with two cannon and four machine-guns. The speed, ceiling, and armor of the newest Spitfire remain secret, however. It can really be classed as a completely new machine, though a development of a well-tried type.

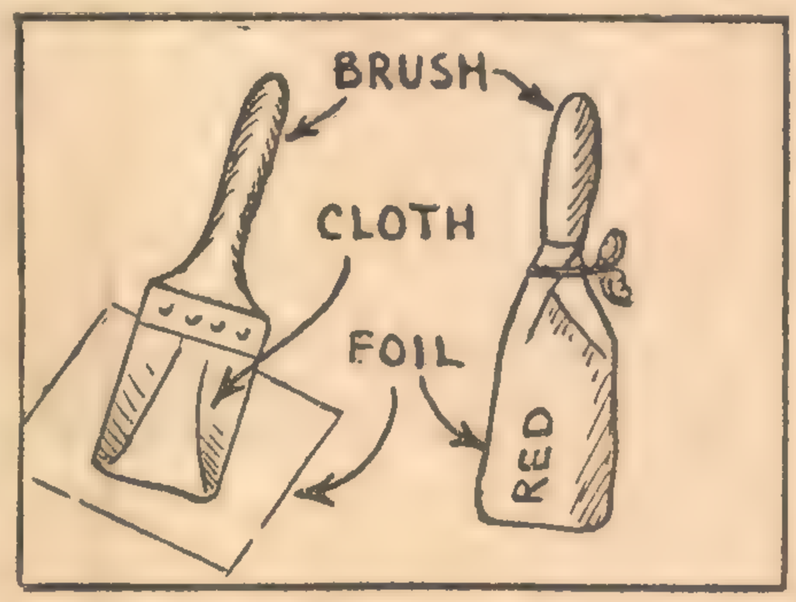
The de Havilland Mosquito bomber, sketched at lower right, came as a nasty surprise to the Nazis when its deadly effectiveness was first felt by their occupation forces in Norway.

Most outstanding feature of the Mosquito is its simple wooden construction. A twin-engined, mid-wing reconnaissance bomber, its armament probably consists of four cannon and four machine-guns.

Exhaustive tests have shown that some of its wooden parts are less vulnerable than corresponding metal parts in other machines because they are larger and are only pierced by bullets, whereas metal would shatter.

Obviously developed from the de Havilland Comet which won the London-Melbourne air race in 1934 with a flight that astonished the world—71 hours for 12,500 miles—the Mosquito is powered by two Rolls-Royce engines, and its speed is said to be in the vicinity of 400 mph. Its wing-span is 54ft. and its length nearly 41ft.

* * *



PAINT BRUSHES can be kept soft and pliable for long periods if first wrapped in cloth damped with turps and then wrapped in foil or wax paper to make it airtight.

HOW IT WORKS

(Continued from Page 5)

have been using a specially-directed torpedo for attacking convoys, which is aimed at the convoy almost haphazardly but travels on a circular course, the circles decreasing in size as the torpedo runs its course. It is almost impossible for the ships to avoid the missile and the chance of its striking a ship is very much greater than that of a normal, straight-running torpedo.

In accordance with international law, every British torpedo is so fitted that at the end of its run (10,000 yards, or just under six miles), if it has not struck any target, it sinks, due to its air chamber filling with water. The torpedo is thus rendered harmless. Many Japanese torpedoes, however, do not thus conform to the rules.

Japanese torpedoes are of three kinds. One explodes at the end of its run or by a pre-arranged range setting, irrespective of whether it has hit anything. A second type explodes on contact with an object. The third is fitted with a buoyancy chamber near the nose which keeps it floating, detonator uppermost, when its mechanism has run down. It is thus a terrible menace to any passing vessel.

BATTERY OPERATED D/W RECEIVERS

(Continued from Page 38)

ing; in some cases, as in the case of the Crown unit, the desired result can be achieved by utilising a blank section of the main switch.

The matter of the converter bias has already been discussed at length. In some kits the grid returns of the R-F coils will need to be identified and connected separately. If you cannot managed to separate the returns, connect them either to the AVC or fixed bias source; in either case, in this circuit, minimum grid bias will be —3.0 volts.

The underneath wiring diagram shown in Figure 9 has been drawn out for the Crown PU-3 unit. It will not be much of a help to enthusiasts desiring to use other units. However, under the present conditions, it is impossible to attempt to draw out a diagram to cover all the kits, past and present, which are likely to be pressed into service.

The chassis used for the receiver was actually one designed for an almost identical set many months ago. It is difficult to say what the position will be in the future in regard to new chassis. Enthusiasts who are merely adapting or rebuilding an old receiver will not be worried by this problem.

If you use the Crown unit, see that the chassis is at least 3½ inches deep so that there will be ample clearance for the adjusting screws. The photographs and the diagrams give a fairly good idea of the general layout and arrangement of the parts.

Although designed particularly around a dual-wave receiver, the circuit would be entirely suitable for a straight broadcast set, omitting the fixed bias lead to the converter valve and the oscillator anode feed to the S/W oscillator coil.

Joe's Column

NOWADAYS there are thousands of people working on lathes, drill presses, grinders, milling machines, and other shop machinery who, a couple of years ago, would have thought that a lathe dog was an animal kept to guard a workshop. These people are doing an important job, and all factory managements see that they handle machines in a safe manner, and that every machine is fitted with the proper guards to prevent the unwary worker being caught accidentally by some moving part.

By the way, I hope none of my readers are numbered among those who think it smart to remove the guards when there are no inspectors about. It may speed up the job on hand, but it may easily cost you some fingers.

There is an added method of making machines safer that has caught on overseas and could also be used to advantage out here—in home workshops as well as large factories. Two tins of paint are the only requirements.

It has been found that if a machine is painted in two colors, its moving parts are easily detected, and it is not only a safer machine to operate, but the eye strain on a job is considerably reduced.

Exhaustive tests have been made, and the two best colors to be used are a light buff and a medium grey. It has been found that the most effective way of painting a shop machine is to make it a light buff around the working area and a medium grey on the remaining areas. The paint should be oil-resistant and washable, and should dry with a satiny, non-glaring finish. Machined surfaces are left unpainted.

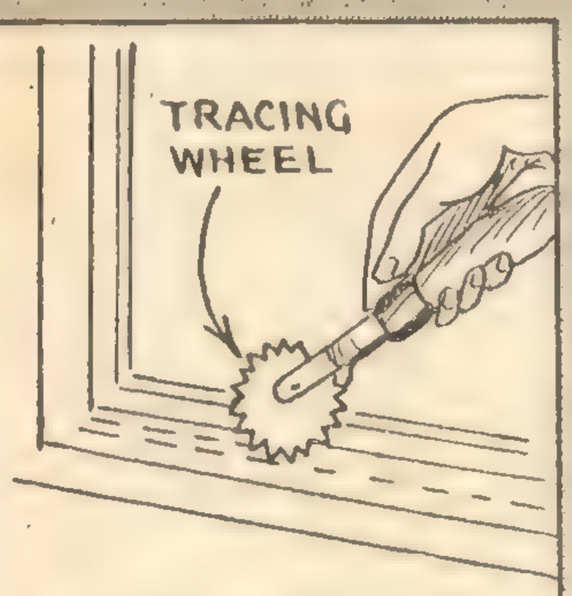
The painting of a machine immediately improves its appearance, but that's only a minor advantage. The light buff "spotlights" the job by reflecting more light on it and the tools, and makes the control handles, knobs, and other important parts, stand out in better contrast. The colors are such that the eye can move from one to the other without experiencing an abrupt change of brightness.

The "spotlighting" effect draws attention to danger areas, thus reducing accidents, and this color combination makes the work stand out with a positive, three-dimensional quality against the machine itself.

Before painting any metal surface, make sure it is clean and free from grease. Remove all the old paint, if convenient, or make it smooth. Apply whatever primer the finishing material may require. When using lacquers, remember that some lacquer solvents will loosen old oil paint or enamel.

In my opinion, the day will not be far distant when all new shop machinery will be produced with the two-color finish already incorporated. But, meantime, some paint added here and there can certainly improve the machines we are working on now.

HINTS FOR THE HOME HANDYMAN



PUTTY ANCHORAGE

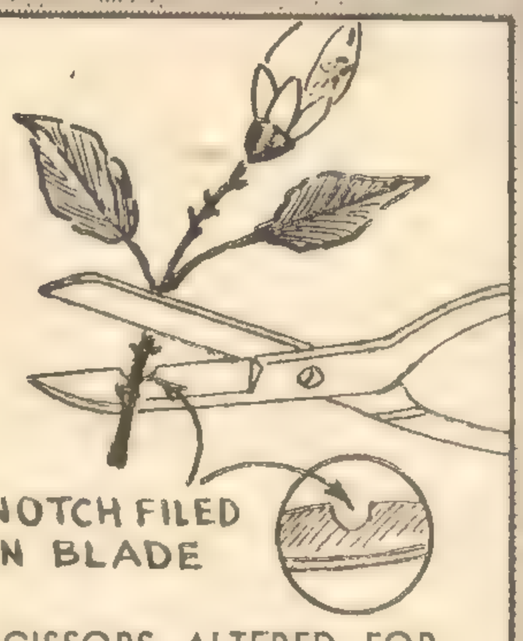
To provide a good anchorage for putty, when glazing windows, take a steel tracing wheel and score the sash, as shown above. The putty will be anchored firmly when pressed into the score marks.

REPAIRING FOUNTAIN PEN

When the threads on your fountain pen wear down and the cap keeps falling off, carefully file off the end of the pen to allow it to screw further into the cap. The fresh threads engaged will often hold the cap firmly.

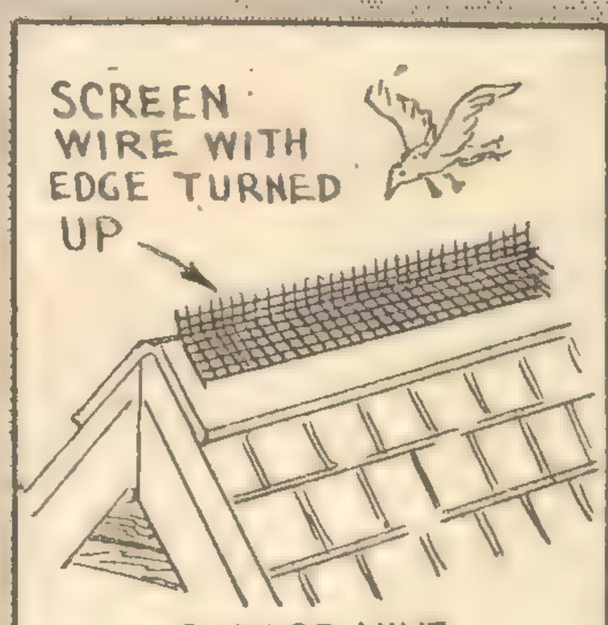
HANDY SHAVING MIRROR

An ordinary hand-mirror can be adapted for shaving purposes by bending a wire coat-hanger to the shape shown, thus forming a holder for the mirror.



SCISSORS ALTERED FOR FLOWER-CUTTING

An old pair of scissors can be improved for flower-cutting by having a notch filed or ground in lower blade. This holds the stem and prevents it slipping.



GARAGE HINT

To keep the roof of your garage free from birds, get several lengths of screen wire, such as is used for flyproof doors, fray one edge and tack along the ridging, as shown in the above sketch. Birds cannot alight on the edging.

LANCASTER LOOPS WITH FULL LOAD

AN RAF four-engined Lancaster bomber, with a full bomb-load, looped the loop in a recent raid over Germany.

The Lancaster looped when taking evasive action in heavy gunfire.

Its feat amazed experts, who had previously held that aerobatics were impossible for very large machines.

The plane was climbing when a heavy shell exploded underneath, tossing the plane on to its back.

The pilot kept control and completed the loop in a dive that must have carried the Lancaster's speed to nearly 400 miles an hour.

The bomber was unharmed and went on to bomb its target.

BROADCAST BAND DX

by Roy Hallett

FINE START FOR 1943

1943 has opened particularly well as far as DX'ers are concerned, as many listeners in this country have, during the last few weeks, reported splendid signals from a number of broadcast Band stations, often many thousands of miles away. Stations in Europe, Asia, North America and throughout the Pacific area, are at present audible at suitable times at widely scattered locations.

MR. BERNDT, one of our Queensland reporters, reports hearing KFBK, Sacramento, Calif., USA, on 1530kc, with an R9 signal. He tells us that it is at times equal to the well-known short-wave station KWID, San Francisco, in strength; our s/w friends doubtless know what a splendid signal KWID puts in here at times. At my location, however, KFBK is not heard nearly so well.

A few DX'ers in this country have been fortunate enough in logging TGW Guatemala City, Guatemala, Central America, on 1520kc. This station has, according to New Zealand's "DX'tra," changed frequency to 610kc, and short-wave station TGWO, formerly of 7260kc., is now on 1520kc. These stations are owned by the one company, and call themselves "The Voice of Guatemala." SW stations TGWA and TGWB are also on this hook-up.

Some mystery surrounds stations being heard on 1050kc. A number of Australians and New Zealanders have been hearing XEAW Reynosa on this channel, as well as 1570kc. The station is said to use the same call (XEAW) on both channels, but presents two different programmes.

A letter to the NZ DX Club, from station XEG, Monterey, Mexico, states that the station is now operating on this frequency, 1050kc., and suggests that New Zealand DX'ers listen for their station. So far, XEG has not been heard on this frequency. XEAW is the station heard at present, so DX'ers may care to watch out for XEG, as they are apparently anxious to obtain reports.

XEG announce as "The Voice of North America," and I understand they use studios located in San Antonio, Texas, USA.

SIBERIAN STATIONS

Stations in Siberia are often heard by DX'ers in this country. One morning recently I came across one on approximately 870kc., with a programme of Siberian songs. I wondered whether or not any short-wave stations may be relaying this one, so ran round the SW bands, and, sure enough, up on the 50 metre band there was a powerful signal, radiating the same programme as the station on broadcast band. A talk by a young lady announcer was presented at 12.45 am. Quite a number of USSR stations have been heard recently, but they appear to change frequency quite often, so it is hardly worth while listing all those heard.

Some weeks back, one of our Queensland DX'ers reported hearing a strange station around 7.30 pm on 1560kc., playing gramophone records, mainly Regal-Zonophone and Decca discs, and announcing their titles, but giving no call sign whatsoever. This station is also heard in New Zealand, and has been heard also on 740kc., 1280kc., and lately 1100kc.

The NZ radio officials are anxious to obtain details concerning this station, as it is believed in some circles that it is an illegal station, operating possibly from somewhere in New Zealand. It was heard in NZ a few Sundays back, closing at 7.0 pm EAST, on 1100kc. approximately. Listeners are advised to watch out for this alleged "pirate," as it should be very interesting to learn just where it is located, and who is operating this station.

Elsewhere on this page may be found a list of some European stations likely to be heard in Australia during the next few weeks. This list is by no means complete so those interested in logging Europeans should watch out for many more than we have listed in this section.

Few European countries allot call signs to their stations. Most European stations are controlled by the Government of their particular country, and stations are given names (such as Rome No. 1, Rome No. 2, London National, &c.) instead of call signs such as we are used to out here.

POLICE TRANSMITTERS

From time to time quite a few DX'ers owning radios tuning above 1600kc. have reported reception of police, ambulance and fire brigade stations operating on this section of the dial (between 1600 and, say, 1650kc.). I have often been asked by these reporters whether or not such stations verify reports from DX'ers.

A DX'er, Mr. Ken Austin, Dandenong, Vic., told me some time ago that he had received a letter verifying his reception of the NSW police station, VKG, but a report sent by the writer to this station was not acknowledged. The writer would welcome any information any of our readers may have concerning such stations as VKG, VJA3 (Sydney ambulance service), VKC (Melbourne police), VKK (Sydney County Council service).

At times some of the USA police stations have been logged in this country on the same region of the dial.

READERS' REPORTS

The writer would like to thank the following for taking the time and trouble to send along reports for this month's issue:—

A. S. Condon, Laura, SA; D. Berndt, Wootha, Qld.; G. Munro, Warragul, Vic.; G. Bennett, Proserpine, Qld.; A. T. Cushen, Invercargill, NZ; Dr. Gaden, Quilpie, Qld.; L. Gliddon, Upwey, Vic.; L. Walker, Applecross, WA; E. Suffolk, Summertown, SA; R. K. Clack, Somewhere in Australia; G. Obey, Bronte, NSW; W. R. Holland, Canterbury, Vic.

LISTEN FOR THESE STATIONS

HERE is a list of some European stations likely to be heard in this country during the next few weeks. While it is useless writing to these stations for verifications, as most of them are in enemy-occupied territory, it is interesting to know just what station one is listening to. Watch for these, and perhaps many others, around 4 to 6 am, just prior to sunrise.

EUROPE.

One of our South Australian reporters, Mr. Ern Suffolk, heard more than 70 European during one morning's listening.

546kc., Budapest, Hungary.
574kc., Stuttgart, Germany.
592kc., Vienna, Austria.
620kc., Cairo, Egypt.
638kc., Prague, Czechoslovakia.
648kc., Lyons, France.
677kc., Sottens.
713kc., Rome, Italy, No. 1.
740kc., Munich, Germany.
776kc., Toulouse, France.
850kc., Sofia, Bulgaria.
877kc., London, England.
922kc., Brno.
950kc., Breslau, Germany.
1004kc., Bratislava, Czechoslovakia.
1031kc., Konigsberg, Germany.
1050kc., Start Point, England.
1131kc., Horby.
1149kc., London, England.
1185kc., Nice Cote, France.
1222kc., Rome No. 2, Italy.
1357kc., Genoa, Italy.
1397kc., Lyons, France.

★ ★ ★

The following is a list of comparatively easily logged stations in countries overseas.

NEW ZEALAND.—Try for these at night, say 8.0 to 10.30 pm, unless otherwise stated:
2YA, 570kc., Wellington. News, 9 pm.
1LA, 640kc., Auckland. Closes shortly after the relay of the BBC 10 pm news.
2YC, 840kc., Wellington, NZ.
3YL, 1200kc., Christchurch.
3ZB, 1430kc., Christchurch. Heard after 2W closes at 10.30 pm until it closes down at 11 pm our time, midnight in NZ.

NORTH AMERICA.—Watch for these, and many others, around midnight:—
KFI, 640kc., Los Angeles, Calif., USA. Suffers interference from XGAP Pekin, but is often stronger than the latter.
KPO, 680kc., San Francisco, Calif., USA.
KIRO, 710kc., Seattle, Wash., USA. Good here with news at 1.30 am. Also heard through KNX.
KHJ, 930kc., Los Angeles, Calif., USA.
KOMO, 950kc., Seattle, Wash., USA.
KNX, 1070kc., Los Angeles, Calif., USA. Suffers from interference from 6WB, Katanning, WA, till 12.30 am.
KRLD, 1080kc., Dallas, Texas, USA.
KWKH, 1130kc., Shreveport, La., USA.
KSL, 1160kc., Salt Lake City, Utah, USA. Best around 11 pm.
KVOO, 1170kc., Tulsa, Oklahoma, USA.
WOAI, 1200kc., San Antonio, Texas, USA.
KYA, 1260kc., San Francisco, Calif., USA.
KSTP, 1500kc., Saint Paul, Minn., USA. Better around 11.0 pm.
KOMA, 1520kc., Oklahoma City, Okla., USA.
KFBK, 1530kc., Sacramento, Calif., USA.
XEAW, 1570kc. Reynosa, Mexico (studios, Dallas, Texas, USA).

ASIA.—Try for these, and watch for plenty of other Asiatics around 1.0 am, when they are usually best heard:—
VUT, 758kc., Trichinopoly, India.
HS7PJ, 825kc., Bangkok, Thailand. One of the best Asiatic stations here.
XOJB, 900kc., Shanghai, China.
VUW, 1022kc., Lucknow, India.
XGOP, 1150kc., Somewhere in China.
VUY, 1167kc., Dacca, India. Usually the strongest Indian here. News in English in chain with other Indians, 1.50 am. BBC news at 2.0 am.

ITEMS OF NEWS FROM U. S. A.

MR. A. CONDON, Laura, SA, sends along some interesting items which he noticed in a copy of the American DX magazine, "Universalite," which has just reached him.

According to this publication, the location of the Indian station heard by many of us on 630kc. is, as suggested by Mr. Cushen some time back, at Patna. So those anxious to obtain a verification from this comparatively newcomer may care to send a report, addressed to All India Radio, Patna, India.

"Universalite" also carries the news that station KITE, Kansas City, USA, has changed call sign to KXKX, and that another well-known American station to Australian DX'ers, WLAC, Nashville, Tenn., USA, has increased power to 50kw.

Quite a long, interesting letter of verification was received by Mr. Berndt a short while back from Station KXEL, Waterloo, Iowa, USA, heard on 1540kc. The station radiates a power of 50kw. and is a unit of the Blue network of the national Broadcasting Company. The authorities at KXEL also sent our friend a list of broadcasting stations operating at present in the USA.

DX reports for the March issue should reach Mr. Roy Hallett not later than Saturday, February 6, 1943. His address is 36 Baker-street, Enfield.

ANSWERS TO CORRESPONDENTS

UNDER THE PERSONAL SUPERVISION OF THE TECHNICAL EDITOR

QUERY SERVICES

ORDINARY technical queries will be answered on this page in strict otation. Readers who desire an answer y mail should enclose a postal note or amps to the value of one shilling. We re short of staff, but we will do our best answer as promptly as possible. Make our letters clear and to the point and o not ask us to draw out special cir-uits, as this is quite impossible at the oment.

.A.P. (Sefton) mentions that there appears be a mistake in the equation on page 31 the December issue of "R. and H."

.: Yes, N.A.P., there was a slip. Correct wer is X equals 2.

.L.F. (Beckom) makes suggestions in regard the design of a 3-valve regenerative battery eiver. He also comments favorably on the torial in the December issue.

.: Thanks, R.L.F., for the suggestions. We e to oblige soon with a circuit along the s required. We are dubious about the AVC t of it. We do not say that the scheme mpossible, but the operation of the circuit be so inefficient as not to be worth while. nks for the support for the policy adopted in matter of licensing.

.D. (College View) sends in his sub. to "R. H." He inquires as to the possibility of describing a short-wave receiver in the r future.

.: Thanks, A.D., for the sub., which has been recorded. We have definite plans regard to a short-wave receiver. We hope will materialise shortly, although there ns so much to publish and so little time space available.

.J.P. (Dover, Tas.) reports that he has built a windcharger along the lines recently de-bed and the finished job turns out 30 amps. hout any trouble in a good wind. Problem o cut down speed and output!

.: Delighted to hear of your success, L.J.P. m the information available, you should able to arrange a suitable method of con-. With regard to the receiver mentioned, put and quality would depend a lot on gn. However, all things being equal, we ot whether there should be any startling erence.

.J.S. (Silver Bell, Qld.) is keen to rewind auto generator for a direct drive wind-rger.

.: Rewinding requires a considerable amount care and also an amount of rather hard-et wire. Sorry, but we cannot help you he matter of rewinding the particular type generator, although we have come across hort general article which may help. We nd to publish it as soon as we can find n for it. For an electric soldering iron, east 60 watts of heating power is required. s would mean a drain of 10 amps. from a lt accumulator—rather an impracticable re for most purposes.

H.B. (Stanthorpe) reports that he has built the Battery Operated amplifier and is very sed with the results. He says that there mple volume for a small dance hall.

: Pleased to note your success with the lifier, also with the Long Range Battery circuit. The 20,000 ohm. transformer would k quite well, although something nearer correct value is desirable. The slight stling denotes some form of oscillation. earthing the chassis. Make sure that the frame of the pickup is connected to chassis and try connecting the frame of the speaker also to the chassis. See that the input leads are well shielded and that the plate leads are kept away from the input circuit. We assume that you took good care to see that you have not mixed things up in the plate circuit of the upper output valve.

E.C.J. comments favorably on the editorial in the December issue.

A.: Thanks, E.C.J., for your letter. It was one of many expressing similar sentiments.

M.M. (Merewether, NSW) sends in a short-wave report and asks about his receiver, which is noisy for a certain period after switching on.

A.: Your letter has duly been forwarded to Mr. Ted Whiting. With regard to the receiver, there are so many possible causes for the trouble that it is impossible to help you much. Most likely cause would be one of the valves with a poor internal contact or a short which becomes evident as it heats up. If you cannot locate the trouble yourself, it is really a job for a serviceman.

"Marconi II" (Auburn, NSW) has built up the simple short-wave converter but complains that he only receives phone stations on certain defined bands and that the unit does not cover 13 and 16 metres.

A.: Actually, phone signals are only heard on certain defined bands, the rest of the frequency spectrum being occupied by commercial Morse stations of one type and another. To judge by your log of stations, the little job is not doing too badly. It is possible that the condenser you are using has a high minimum capacitance which prevents the converter from tuning down to the bands required. Try removing a turn or two from the secondary of the coil and a proportionate amount from the primary. To cover from, say, 35 metres up, wind another coil with about twice the number of turns. Don't be afraid to experiment to obtain satisfactory coverage. Main point to watch is to keep the proportion of primary and secondary turns fairly constant and the connections as shown in the original article.

A.M.K. (Leederville, WA) makes some generally appreciative remarks about "R. and H." and various circuit designs published from time to time. He is interested in the battery amplifier.

A.: Thanks, A.M.K., for your letter and the various suggestions. Glad to note that you have had so much success with our circuits. Re the recently described battery amplifier, we avoided the use of the 19 type valve because of the necessity for special driving circuits. The 19 would not put up much of a performance with resistance coupled input as you suggest. It must be driven well into the grid current region for anything like useful power output. There is quite a long story behind the design of big dual-wave battery sets and your interest in this line should be satisfied very soon. The Yank one-valver is interesting enough but not applicable to Australian conditions.

R.D. (Shepparton, Vic.) asks some questions in regard to model planes and gliders and makes some suggestions re the make-up of "R. and H."

A.: Sorry, but we are not in a position to answer in details your questions re gliders. As you are so keen on the hobby, why not experiment in these matters for yourself? Aviation is certainly a topic of interest at the moment, but we cannot see our way clear to increase the proportion of space devoted to it. We are watching carefully the parts position and will adjust the nature of our technical articles to suit. Thanks for your interest and suggestions.

J.E.C. (Orange, NSW) asks about a circuit of an amplifier to use certain parts which are on hand.

A.: We suggest that you follow the circuit of amplifier PA—3, described in the April, 1942, issue. However, you will have to have the speaker field coil changed. A resistance of 2500 ohms. is really too high for use in an ordinary push-pull amplifier.

G.D.M. (Port Augusta, SA) asks about the construction of a filter choke and as to the possibility of obtaining the April, 1942, issue of "R. and H."

A.: For your purposes, you could construct a reasonably effective filter choke by obtaining a transformer core, making up a former to suit and winding on as many turns as possible of about 32 B. and S. gauge wire. Generally speaking, the larger the core, the higher will be the inductance. When reassembling the core, arrange it with a butt joint and clamp the laminations together as tightly as possible. We cannot supply the April issue. Some other reader may be able to help if you advertise for it.

H.R.I. (Toorak) relates his experiences with a preamplifier circuit he has tried out.

A.: Thanks for the letter and suggestions. We are prepared to believe that the arrangement gives wider frequency response due to the lower impedance of the circuits. However, the difference would only be apparent on gear of the standard which you possess. We are quite unable to see how it would reduce needle scratch and must be sceptical about this for the time being. The fact that you escaped hum trouble is also probably a matter of good fortune rather than anything connected with the constants of the circuit. Most likely source of hum in electromagnetic and this is not in any way connected with the operating conditions of the preamplifier valve, except insofar as they affect overall gain.

R.J.W. (Abbotsford, NSW) has a six-valve receiver which makes a loud rumbling noise when first started up on the broadcast band.

A.: It is hard to say exactly what may be the trouble. However, it is apparently some form of instability and, as it has developed only recently, we are inclined to put it down to a failing filter condenser. Try a new 8 mfd. electrolytic between B-plus and chassis. On the other hand, one of the other bypass condensers may have become open-circuited. Things like this have usually to be traced by trial and error.

M.R. (Yandilla Siding, Qld.) asks about home recording and about a radio receiver.

A.: Thanks for the subscription to "Radio and Hobbies," which has duly been recorded. The surface of ordinary commercial records is quite hard and, even if it were possible to shave off the existing grooves, an ordinary recorder would probably makes little impression. Proper recording blanks are the answer to your problem, if you can obtain them. It is quite impossible to say what is the trouble with your commercial receiver, although most likely cause would be something amiss in the back-bias network. It is really a job for an expert on the spot.

P.H. (Gympie, Qld.) asks about the circuit for a small short-wave set.

A.: Your letter is not very explicit in that you do not make it clear just what you mean by a "small short-wave set." If you mean a single-valve job, you could build up one of the little sets featured in the January issue. Coil data is given in the same issue. Alternatively, you could build up one of the two valve circuits with suitable plug-in short-wave coils. The dual-wave "Little General" is a small superhet., although not the best for one who is mainly interested in DX listening. If you want a good, simple superhet. circuit, the best proposition would be the "Jeep" five-valver, built up as a dual-wave receiver. All these circuits are in the January, 1943, issue.

D.S. (Moonee Ponds, Vic.) mentions an error in a recent maths. article.

A.: Thanks for your letter, D.S. No doubt you have seen the correction note in the subsequent issue.

SHORT-WAVE REPORTS

E. Larsen, Footscray, Vic.: Glad to hear from you again. As regards the circuit, we suggest that you follow one of the circuits which appear in "R. & H." from time to time. Let us know how you go.

A. T. Cushen, Invercargill, N.Z.: Hope that you enjoyed the holiday. Thanks very much for the dope, and hope that you are once again logging those stations.

J. W. Swingle, Hawthorne, Q.: Will you please repeat the request you made some time ago, as we have lost your letter. Hope to hear from you soon. Thanks for the remarks.

J. Shiel, Melbourne, Vic.: You are doing very well, and hope to receive quite large logs in the near future.

G. Latham, Warrawee, NSW: Thanks very much for the log you sent me this month. You will find all the calls in the list.

J. A. Bate, Merriwa, NSW: Welcome to our pages, and we hope that you will find the hobby as absorbing as we have. Good luck.

M. Morris, Merewether, NSW: Thanks for the photograph. We have quite a collection now. We have heard KZRH for some weeks now. All the best.

A. T. Johnson, Maylands, WA: Thanks for the new one. As yet we have not heard them. The card is a good one.

Dr. K. B. Gaden, Quilpie, Qld.: Hope that you received our letter. We are glad to hear that the veris are coming in well. All the best.

H. Perkins, Malanda, Q: Not keen on your choice of film stars. Very early morning reception is now very good. The log is very fine indeed.

R. Nolan, West Perth, WA: You take a lot of care in compiling your log, and you always seem to drag in a few good ones. Glad to hear that you are also getting Tananarive.

B. Stern, North Bondi, NSW: Welcome to yet another reporter, and if you keep up the standard you have commenced with you will be turning in some very fine logs. Good luck.

W. Harvey, Dubbo, NSW: Thanks for the letter. See note on how to convert kilocycles to metres and vice-versa. There are plenty of new ones for you to chase up now.

R. Fisher, Caulfield, Vic.: Welcome to you also. We are glad to learn that you are hearing so many stations. Will be pleased to hear from you again. At 12 years, you must be our youngest reporter.

W. Williams, Bellevue Hill, NSW: Thanks for the letter. Glad to learn that you also have a card from KWID.

P. J. Grigg, Geelong East, Vic.: Keep up the good work. There are a lot of stations which you are not hearing. The wishes are reciprocated.

A. S. Condon, Laura, SA: Thanks for the very fine log. We will be sorry to lose you, but in better times we will look forward to your return. Glad the set is going so well. Regards.

L. Walker, Applecross, WA: Thanks for the log and the details, which you will see we have included in our notes.

L. J. Keast, Carlingford, NSW: Very pleased to get your letter. Thanks for the information. Will drop in to see you one of these days. All the best.

R. Gillett, Dudley Park, SA: Very glad to hear from you again. The log is an excellent one, and shows the large amount of time you spend at the receiver. Am writing to you. Regards.

A. McKenzie, Bexley, NSW: We are getting the dope you require. Why not send us in a log from month to month?

E. G. Fluck, Flinders Park, Vic.: Your log is a very interesting one. Welcome to our pages.

A. Lee, Newcastle, NSW: By the time this reaches you we hope you will have received our letter. Hope that reception conditions look up for you.

H. O. Nicholson, Glen Iris, Vic.: Another new reporter whom we welcome. Your little set seems to be very good indeed. Keep up the good work.

A. H. Wass, Wagga, NSW: You are doing well up there. Hope that the reception keeps up for you. Will hope to get a further log next month.

N. A. Hanson, Merrylands, NSW: Yes, another one is just what I said when I received your letter. Hope that all turns out well. Also hope the dial is a success.

B. M. Walker, Christchurch, NZ: Always pleased to hear from the shaky isles. Will let you have the dope soon. A report next month?

D. McKinnon, Strathfield, NSW: Your letter leaves me speechless. Will be pleased to hear the trouble has been cleared up.

J. Teare, Oakleigh, Vic.: We are always pleased to hear from new reporters, and there are no formalities, just write. Regards.

A. E. Moore, Brisbane, Q: Thanks for the new ones, but they had already been reported. However, we were glad of your detailed information.

G. Smart, South Caulfield, Vic.: Had just about given you up for lost, but hope you will get more time to listen now. There are plenty of them for you to have a go at. All the best.

J. N. Paris, Adelaide, SA: Will be pleased to hear that the receiver is once again in running order. However, you did very well under the circumstances. Regards.

Broadcast DX

L. Gliddon (Upwey, Vic.): Thanks for the card, Leigh; it is quite an attractive one. Glad you've joined the ADXRC and AWAWDXC. Glad your brother was pleased to see your name in R. & H.

E. Suffolk (Summertown, SA): Thanks for the card, Ern. Hope you, Wally, Dud and Co. spent a pleasant Christmas. How do you like that show 9 to 10 pm Fridays, 2YA? Pretty good, isn't it?

E. Tinning (Kew, Vic.): Thanks for the card, Ted. Naturally, I was very pleased to receive it. I'm sure we all hope that this time next year many of our DX enthusiasts now in the Services here and overseas will be back on the job again, here at home. 73's and good DX.

D. Berndt (Wotha, Qld.): Wish I had been with you when KFBK was R9 Q5. Not much chance of a signal from them like that at my QRA. Thanks for that list of powerful Americans. Keep up the good work at the dials during 1943.

G. Bennett (Proserpine, Qld.): Yes, the old ZB cards, still sent out occasionally, are of the type you showed me, Gordon. Glad you are so pleased with the presentation of our DX page. Hope the DX continues to roll in during 1943.

G. Obey (Bronte, NSW): Thanks for the copy of KC4USA's card. I'm sure Mr. Whiting will be pleased to hear about this. Glad you got KSTP's QSL. The midnight Americans do not seem to be as good out your way this season as they were last.

L. Walker (Applecross, WA): Wish I had seen that display of reports to 6KY in that shop window; it would have been very interesting. Very pleased indeed that you like our DX page and DX tips found in it.

R. K. Clack (Somewhere in Australia): Thanks a lot, Rex, for that copy of "France d'Abord." I am very keen about collecting foreign magazines. Yes, I'll bet you miss that receiver of yours. What a pity you had to part with it. Hope you soon get your verie from KVOO.

Dr. Gaden (Quilpie, Qld.): Always pleased to receive those interesting letters from you. Very pleased that these columns have been of so much help to you with your Broadcast Band DX. Glad you have received those letters from KOMA, XEAW KXEL, &c.

A. S. Condon (Laura, SA): Thanks a lot, Austin, for those splendid reports you have been sending along since this page commenced. Glad to know you, like myself, collect gramophone records; they are pretty hard to get nowadays here in Sydney. My latest verie is from 7LA, Launceston.

A. J. McDonald (Euroa, Vic.): Gosh, we are looking forward to choosing that record, Alf! Hope the portable is still 100 per cent. 73's and good DX from Jean and myself.

W. R. Holland (Canterbury, Vic.): Thanks a lot for that splendid SWL card. Glad to know you are yet another keen DX-er. You seem to have quite a fine batch of QSL's in your collection now.

C. A. Morrison (Normal, Ill., USA): Always look forward to receiving IDA's GC, which still arrives regularly. How about trying a section for Broadcast Band DX-ers again? Would be pleased to know if you or any other DX-ers on your continent are hearing our Aussie Broadcast Band stations these days.

G. Munro (Warragul, Vic.): Pleased to hear from you again. Glad to know you will be able to spend more time at the dials from now on. That s.w. set of yours certainly sounds like a winner.

A. T. Cushen (Invercargill, NZ): Gosh, 2 QSL's in one mail, grand work! My card from KOB arrived whilst writing these columns. This alleged pirate is certainly creating some interest.

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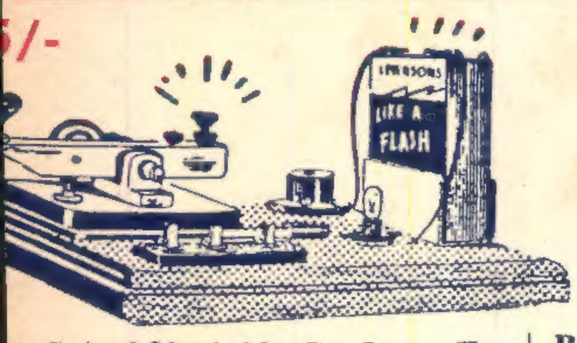

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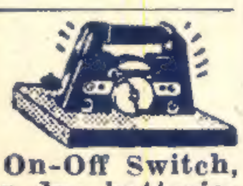

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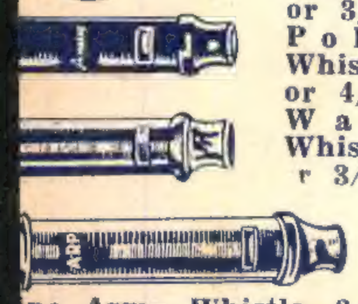

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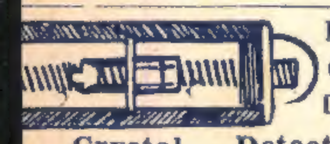

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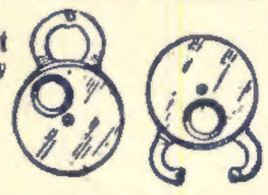

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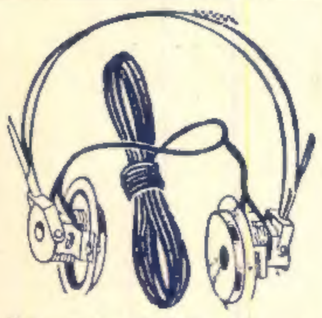

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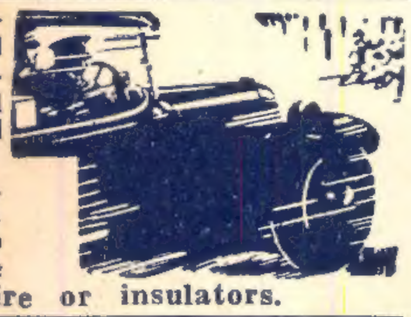

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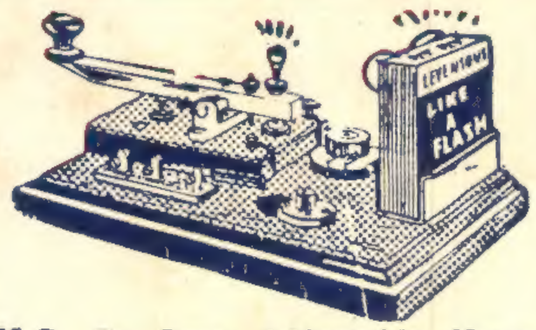

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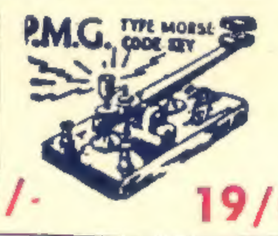

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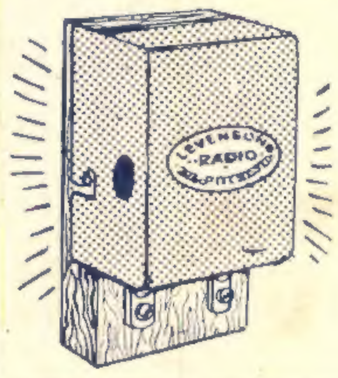

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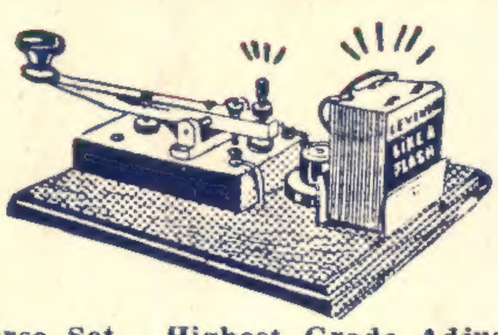

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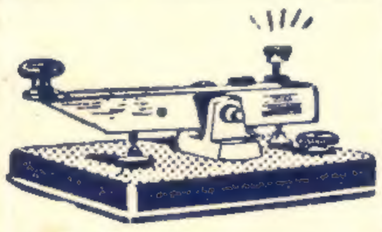

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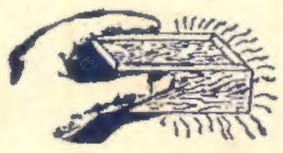

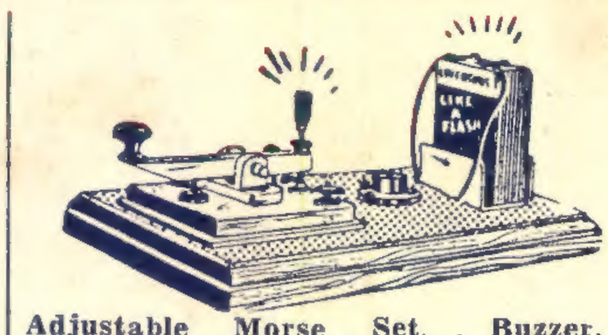

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